RECENT SCIENTIFIC DATES

ARCHAEOLOGICAL SITES OF TAMIL NADU

GOVERNMENT OF TAMIL NADU
DEPARTMENT OF ARCHAEOLOGY

Recent Scientific Dates

Archaeological Sites of Tamil Nadu

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Government of Tamil Nadu

Department of Archaeology

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Foreword

Writing of history is an exercise in ordering the past, and the historical order is built upon a framework of time. The absolute dates available in primary sources, such as inscriptions and copper plates, are then the reconstruction of the human past is perfect. When the written documents are not available for scrutiny or the period involved in the writing history before the advent of the writing system, then scholars rely mostly on archaeology. Indian archaeology has been governed by the arbitrary nature of relative dating methods constructed through the interpretation of pottery, scripts, and stratigraphy. These methods provide sequence but not certainty, leaving vast periods of our past in a persistent twilight. The scholars turned their eyes towards science to get absolute dates for rewriting history with more authenticity and accuracy. The Tamil Nadu State Department of Archaeology (TNSDA) has been involved in these noble exercises in recent years, and it has succeeded to some extent in clearing the chronology of various historical events.

The volume ***Recent Scientific Dates: Archaeological Sites of Tamil Nadu*** offers a profound liberation from the historical uncertainty and ambiguity. The application of chronometric dating techniques such as Accelerator Mass Spectrometry (AMS) and Optically Stimulated Luminescence (OSL) marks a fundamental shift from interpretation to empirical science. This monograph is a landmark testament to that scientific revolution in the archaeology of Tamil Nadu, presenting a body of evidence so robust it will not only reshape the history of Tamil Nadu but also set a new methodological standard for archaeology across the subcontinent.

The research presented here is distinguished by its exemplary rigour. The TNSDA embarked on its recent excavations not as a random search, but with a strategic vision to fill the vast vacuum that has existed throughout the long history of Tamil Nadu. The result is a dataset of

139 scientific dates, their validity secured by processing at a consortium of globally respected institutions and the cross-validation of different dating techniques at key sites. This meticulous approach ensures the report's transformative claims are built on an unshakeable fortress of evidence.

The implications of this new timeline extend globally. The dating of hominin occupation at Attirampakkam estimated between 1.07 and 1.7 million years ago compels a rethinking of "Out of Africa" migration theories. Furthermore, the dates from Sivagalai, placing the introduction of iron as far back as 4th millennium BCE, dismantle the diffusionist model of technological progress flowing from West to East or North to South. It reveals this region as an established ancient centre of metallurgical innovation, contemporary with the Copper Age cultures of the North.

This work is the product of immense dedication. I congratulate the authors, K. Rajan, R. Sivanantham, and V.P. Yathees Kumar, and the entire TNSDA for their visionary leadership and commitment to scientific excellence. By bringing forth these findings with such transparency, they have provided a secure foundation upon which a more accurate and compelling history of South India will be built for generations to come.

Thiru T. Udhayachandran, I.A.S.
Principal Secretary to the Government of Tamil Nadu
Finance Department and Commissioner of Archaeology

Foreword

The study of South India's past has long been characterized by critical, unresolved chronological questions that have limited our understanding of its socio-technological development. Debates concerning the antiquity of iron metallurgy and the origins of literacy and urbanism have persisted for decades, often hampered by a reliance on relative dating methods. The present work marks a significant scholarly contribution by providing a robust corpus of empirical data that directly addresses and resolves these fundamental issues.

First, this report ***Recent Scientific Dates: Archaeological Sites of Tamil Nadu*** presents definitive evidence on the antiquity of iron in the subcontinent. The series of AMS and OSL dates from the urn burial site at Sivagalai, which places the introduction of iron as far back as 3345 BCE, is transformative. This finding scientifically establishes the South Indian Iron Age as contemporary with the Copper Age of North India. Consequently, this data challenges long-held diffusionist models and posits a more complex narrative of parallel technological trajectories within the subcontinent, a conclusion of immense significance for Indian protohistory.

Second, the volume provides a secure timeline for the emergence of literacy and urbanism in the region. The extensive dataset of radiometric dates from sites yielding Tamil̲i (Tamil-Brahmi) inscribed potsherds, such as Keeladi, Sivagalai and Kodumanal, securely places the script's origins in the 7th-6th centuries BCE. This empirically demonstrates that the rise of a literate, urban society in the Anporunai (Tamiraparani), Vaigai and Kaver river valleys was a pre-Mauryan phenomenon, contemporary with the Mahajanapadas of the Gangetic plains. This finding necessitates a crucial revision of previous historical models that assumed a later, derivative process of state formation in the South.

In bringing forth these preliminary findings, before going to the next season of excavation by the TNSDA, they have demonstrated a commendable spirit of academic transparency. In consolidating more than a hundred scientific dates, this work is far more than a simple catalogue. It is a foundational dataset that provides clear, evidence-based answers to some of the most pivotal questions in South Indian archaeology. I commend the authors, K. Rajan, R. Sivanantham, and V.P. Yathees kumar, for presenting this vital data in an accessible format that will serve as an indispensable resource for researchers for years to come.

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Scientific Dates

In any archaeological and historical investigation seeking reconstruction of the past, chronology plays a crucial role. Every record, whether archaeological or historical, is either dated absolutely or relatively based on the content and context of the record. Historical documents, such as Inscriptions, Copper plates, Palm leaf manuscripts and many others are dated based on the absolute date available in the form of regnal years and eras explicitly expressed in the document. When absolute dates are unavailable, relative dating methods are used to arrive at a near approximation, which mostly rely on palaeography, linguistic style, historical inferences, and historical context. At the initial stage, the majority of the Tamili (Tamil-Brahmi) cave inscriptions were dated based on palaeography. In the same way, the majority of the artefacts and inscribed potsherds recovered from archaeological excavations were generally dated based on archaeological stratigraphy and palaeography. On the epigraphical front, the Jambai Tamili cave inscription was dated based on historical inferences. Likewise, the year given in the Pulangkurichchi inscription led to the arrival at two different dates due to the non-specification of the era. Thus, the relative dating is always considered the last resort because of its inherent weakness. As long as written documents with absolute dates are available, the reconstruction of the past is easier. In this case, historical documents with particular deciphered scripts alone can help determine the age. For instance, the earliest written documents of India are the Indus seals and sealings. However, the non-decipherment of the Indus script has hindered our ability to interpret the nature of the Indus Valley Civilisation.

In India's long history, human ancestors appeared around 1.7 million years ago. Since then, prehistoric humans have started communicating orally with their fellows without any written material. The earliest written documents available are the Indus script and graffiti marks that appeared around 5000 years ago. Therefore, reconstruction of more than 17 lakh years of Indian history lies in the hands of archaeologists and scientists (Chart 1). Due to the non-availability of written documents and the non-decipherment of some of the available scripts, such as the Indus scripts and graffiti, the history of a specific cultural context remains dark. The decipherment of Prakrit-Brahmi by James Princep in 1837 and Tamili (Tamil-Brahmi) by K.V.Subramanya Aiyer in 1924 led to the writing of Indian history with a certain amount of chronological clarity. Despite the decipherment, the non-availability of any historical clue in most Brahmi inscriptions forced scholars to rely on palaeography. The historical inferences drawn from early Brahmi inscriptions with an apparent reference to the king Asoka assisted the scholars in fixing the date of the Brahmi script to the 3rd century BCE. However, the occurrences of more than 1600 Tamili inscribed potsherds in archaeological stratigraphy of the excavated sites of Tamil Nadu generated an intense debate on their origin, evolution and spread. This situation forced scholars to look for scientific dates to fix the dates of Prakrit-Brahmi and Tamili scripts. The series

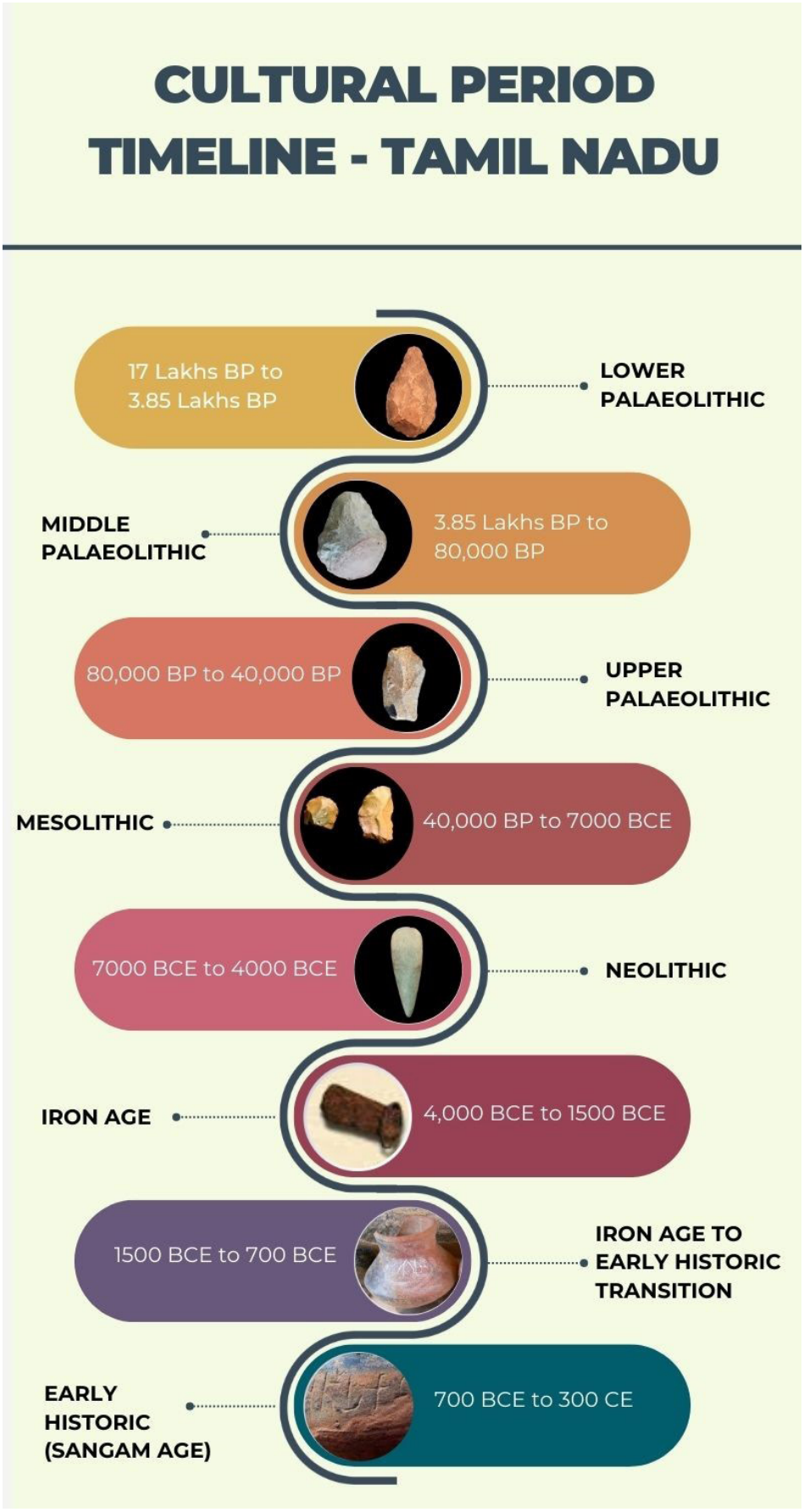

Chart 1: Timeline of the Cultural Periods of Tamil Nadu as per the scientific dates

of AMS dates obtained for the Tamili scripts from the excavated sites such as Kodumanal, Keeladi, and Sivagalai and others pushed the date of Tamili script to the 7th-6th century BCE. Thus, the scientific dates obtained in archaeological investigations over time settled some of the intriguing issues and unsettled some of the settled issues.

Scientific dates have become an integral part of archaeological investigations. Therefore, the Tamil Nadu State Department of Archaeology took major initiatives in getting scientific dates for archaeological materials. The earnest efforts in this direction yielded valuable scientific data in the domains of Prehistoric, Protohistoric, Iron Age, and Early Historic studies. In total, 139 scientific dates were obtained in the field of Accelerator Mass Spectrometry (AMS) (127), Optically Stimulated Luminescence (OSL) (11), and Cosmogenic Nuclide (1) (Table 1,2 and 11; Fig. 1). Irrespective of these valuable dates obtained from a particular geographical zone, they fail to solve all the cultural phases of Tamil Nadu due to the varied nature of the cultural growth. The terminology used to denote a particular cultural period also came under intensive discussion due to a lack of clarity. The prehistoric period is broadly divided into Lower, Middle and Upper Palaeolithic, followed by Mesolithic and Neolithic (Chart 2). The linear period assigned to each cultural phase has also been questioned recently. The vast geographical area and different cultural growths experienced in each zone fail to fall within the specified chronological parameter. The uneven development and co-existence of parallel cultures at different scales further complicated the issues. For instance, when the Indus Valley experienced an advanced civilization in all spheres of life, the contemporary geographical/cultural zones in other parts of India experienced early farming subsistence patterns, as one noticed in the Central Chalcolithic culture and the Southern Neolithic culture. In few cases, the lives of the people were so rudimentary. Therefore, having a blanket terminology or expecting a uniform subsistence pattern or cultural/economic growth in all geographical zones is very difficult. The availability of resources and the level of technology adopted to exploit resources or convert them to their advantage determine the nature of cultural growth. Therefore, understanding each cultural item chronologically and spatially is essential and scientific dates are required to place them in a proper time frame. Tamil Nadu has witnessed such differential cultural growth throughout its long history. Understanding various cultural manifestations against recent scientific dates is important to situate or comprehend the cultural horizon.

In Indian context, the term protohistory, though the usage is minimized in recent years, is being used to define a cultural period between Prehistoric and Early Historic period comprising the Bronze Age of Indus Valley Civilization and Copper Age of Central Chalcolithic and Iron Age of Southern India approximately falling between the middle of 4th millennium BCE and 7th-6th century BCE. Considering the Three-Age theory, it is presumed that the Iron Age is followed by the Copper Age. However, the recent stratigraphic evidence and radiometric dates questioned

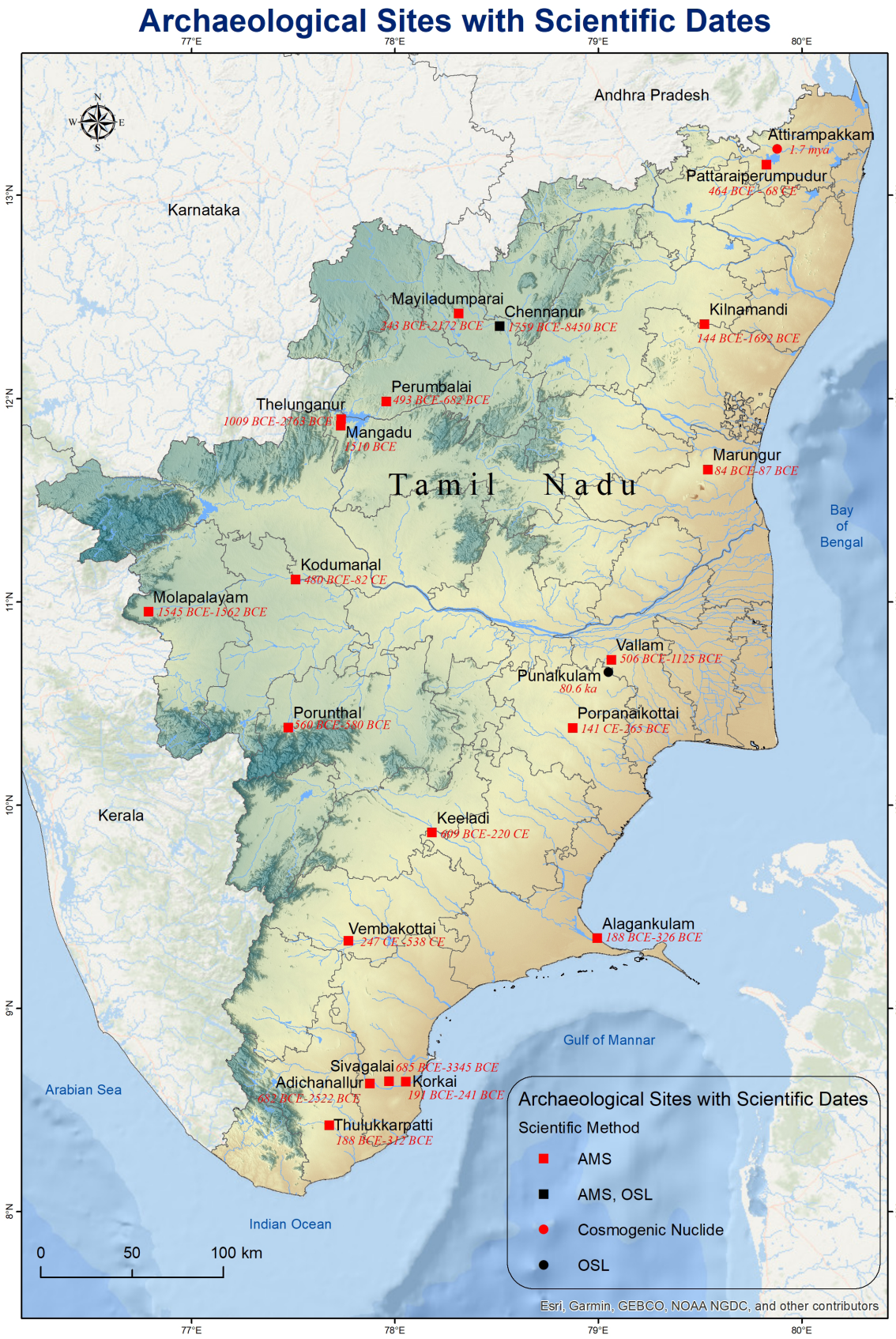

Fig. 1: Archaeological sites with scientific dates

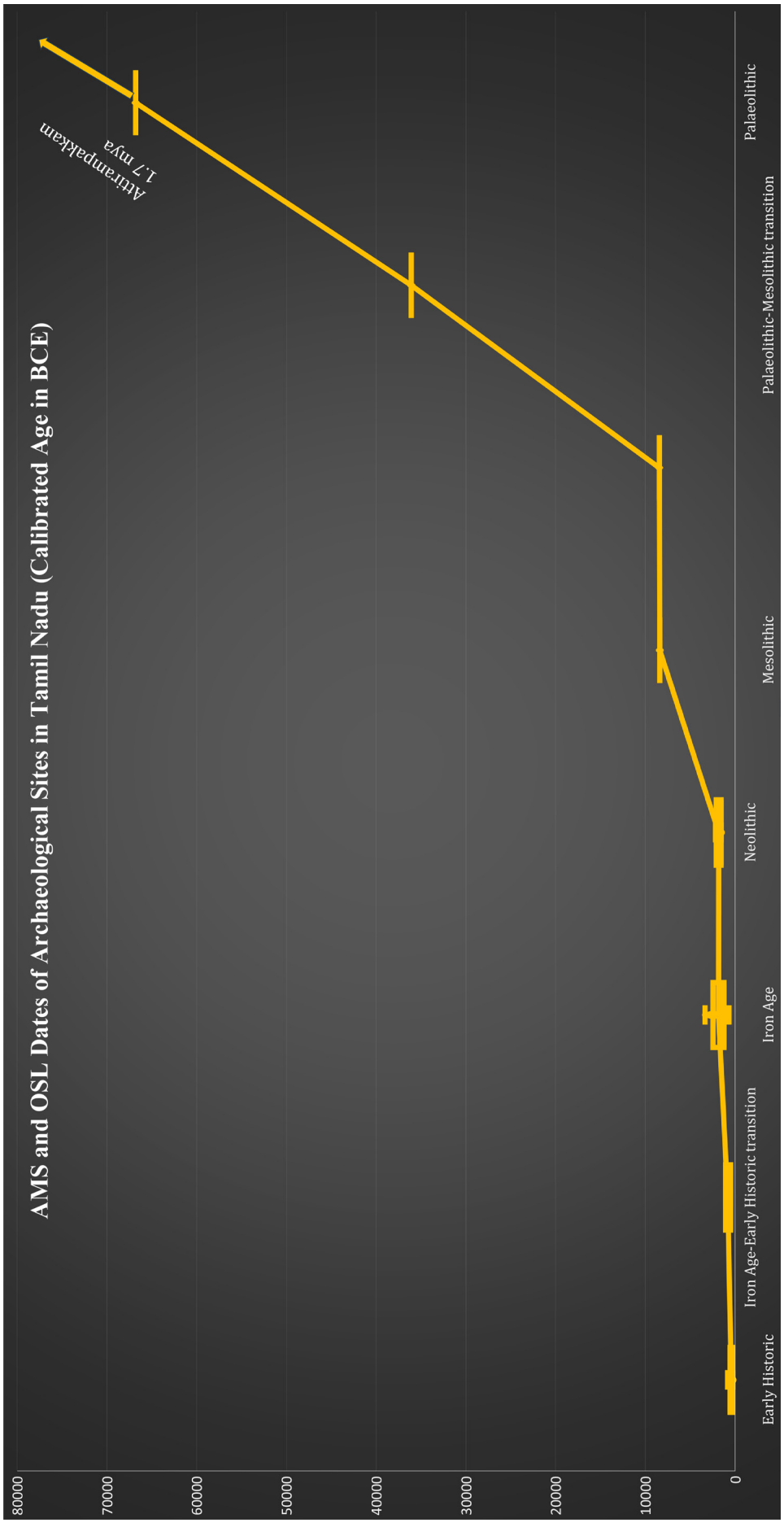

Chart 2: Cultural Periods of Tamil Nadu as per scientific dates

this perception, suggesting an overlapping scenario. The Copper Age was witnessed after the Microlithic phase in certain areas; in some places, the Microlithic phase followed the Neolithic phase and in others, the Microlithic phase followed the Iron Age. There is a total absence of Chalcolithic or Neolithic cultures in certain parts of India, leading to the emergence and transformations of various cultures differently, both in time and space. This precarious situation forces us to deal with each cultural zone independently within an overall cultural frame.

In India, early literary sources such as the Vedas, the Puranas, the Buddhist and Jain literature and the Sangam literary works provided a general time bracket rather than fixing the date accurately. The emergence of second urbanization, the State (Mahajanapadas), chieftains, and sectarian religions like Buddhism and Jainism are considered the beginning of the Early Historic period in the 6th century BCE. It is presumed that the Gangetic Valley is regarded as the core region for the early emergence of the Early Historic period. However, we could not find epigraphical records before the Mauryan empire in the 3rd century BCE, except for a few stray pieces of evidence ascribed to the Pre-Mauryan period. The short texts from Mahasthan, Piprehwa and Sohgaura are conceivably considered Pre-Asokan, but the dispute over their dates remains. The lack of intensive explorations and excavations in other river valleys of India prevented us from getting a clear picture of the emergence of the Early Historic period in India. However, the recent AMS dates suggest that the Early Historic period in India emerged around the 7th-6th century BCE. Thus, understanding each cultural phase in a given geographical zone is important rather than generalizing the chronology of the entire Indian subcontinent and placing them all in a particular time frame. A brief discussion on various cultural phases of Tamil Nadu may provide a better understanding of the problems involved in fixing the date.

Palaeolithic Culture

Prior to chronometric dating methods, the age of prehistoric sites was primarily estimated based on artefact typo-technology or on their relative position in stratigraphic contexts such as in river terraces. Since the first discovery of a Palaeolithic stone tool in India by Robert Bruce Foote in 1863 at Pallavaram and subsequently at Attirampakkam in northern Tamil Nadu, numerous discoveries were made by many scholars. In recent years, Shanti Pappu and Kumar Akhilesh (Sharma Centre for Heritage Education), are leading research focused on prehistory and past environments primarily in the basins of the rivers Kortallaiyar (modern Kushasthalayaru) and Arani, resulting in new observations on numerous sites in this region. This led to the establishment of new interpretations on Quaternary geomorphology, stratigraphic contexts of assemblages, site formation studies, lithic reduction sequences, and hypotheses of hominin behaviour spanning the Lower (Acheulian) and Middle Palaeolithic. Research by the State Department of Archaeology led to excavations at Parikulam and Pattaraiperumbudur that are also leading to new insights. The excavations at Attirampakkam and subsequent surveys

conducted by the Sharma Centre for Heritage Education are leading to the generation of information on sites ranging from the Early Pleistocene Acheulian to Microlithic cultures of the Late Pleistocene. Acheulian occupation at Attirampakkam (Layers 6 to 8) was dated by Palaeomagnetic measurements and direct $^{26}Al/^{10}Be$ burial dating of stone artifacts, that now position the earliest Acheulian levels to between 1.07 and 1.7 Ma (million years ago) with a pooled average age of 1.51 ± 0.07 Ma (Pappu et.al. 2011 published in *Science*) (Fig. 2). These led to rethinking theories of hominin migration 'Out of Africa' and on the evolution of the South Asian Lower Palaeolithic. Luminescence (pIR-IRSL) dating of the layers (2 to 5) overlying the Acheulian at Attirampakkam represented an Early Middle Palaeolithic beginning around 385±64 ka (thousand years ago) and continuing until 172±41 ka (Akhilesh et al. 2018 published in *Nature*) (Fig. 3). These results suggest a re-evaluation of models that relate to the origins of Indian Middle Palaeolithic culture.

Elsewhere in Tamil Nadu, in Ariyalur and Vallam regions and also in Vaigai and Gundar basins of southern Tamil Nadu, Middle Palaeolithic sites have been reported (Raman 1970; Selvakumar 2007, 2008, 2009; Rajan and Ramji 2009). Late Palaeolithic tools occur in a context datable between 42 k and 80 k at Punalkulam, which lies about 18 km from Thanjavur (Selvakumar, pers. comm.). The sediment contexts from the site of Punalkulam, which have artefacts of the Palaeolithic and Mesolithic periods, were dated at NGRI (Chart 3). The artefacts from the upper Mesolithic horizon were dated to 9.8 ± 1.4 ka, and the lower-most context underlying the Palaeolithic artefact horizon produced a date of 80.6 ± 13.8 ka. In comparison, the sediment lying above the Palaeolithic horizon has a 42.4 ± 6.3 ka date. This dating has placed the Palaeolithic artefacts from this region in the Mesolithic context, and they could be placed in the time bracket of 42 to 80 ka (Selvakumar et al. 2017).

The next cultural phase encountered in the adjoining region of the Chittoor cultural zone is the occurrence of Upper Palaeolithic tools (Fig. 4). Though many Upper Palaeolithic sites were noticed in the Chittoor region of Andhra Pradesh, the bordering Vellore region of northern Tamil Nadu met with limited evidence (Kumar 2016). However, the transformation from Middle to Upper Palaeolithic is yet to be assessed in Tamil Nadu with considerable supporting data. The chronology of the Upper Palaeolithic phase of Tamil Nadu is yet to be resolved with concrete scientific dates and artefacts.

Post-Upper Palaeolithic, the cultural phase witnessed in Tamil Nadu is the Microlithic phase. Though the time range of this cultural phase is yet to be determined, it is generally believed that it coincides with the Holocene period. Microlithic sites were found throughout Tamil Nadu, with a concentration in southern Tamil Nadu. The Microlithic tools appeared after the Upper Palaeolithic but continued till the Iron Age, passing through the Neolithic phase. The recent

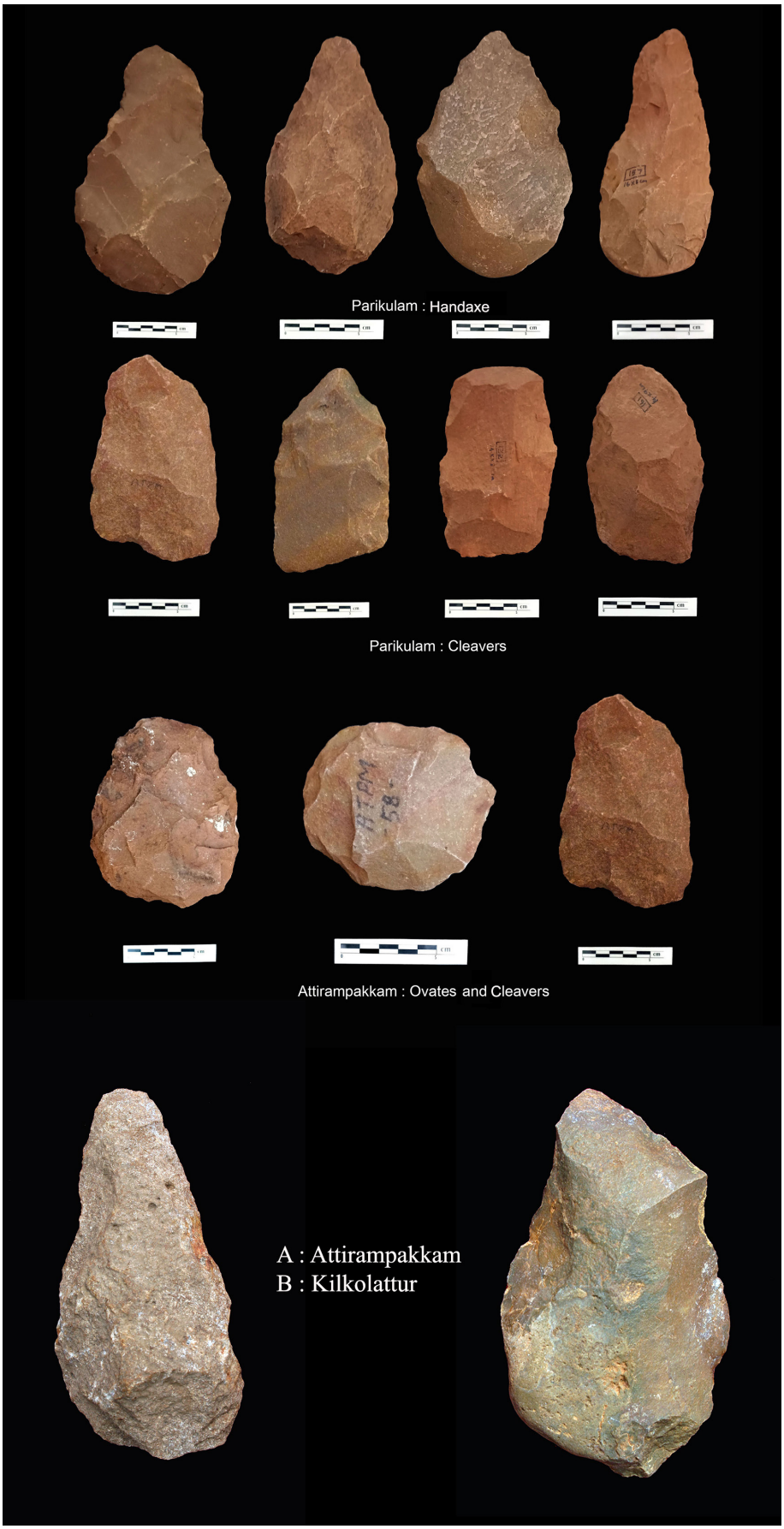

Fig. 2: Lower Palaeolithic tools

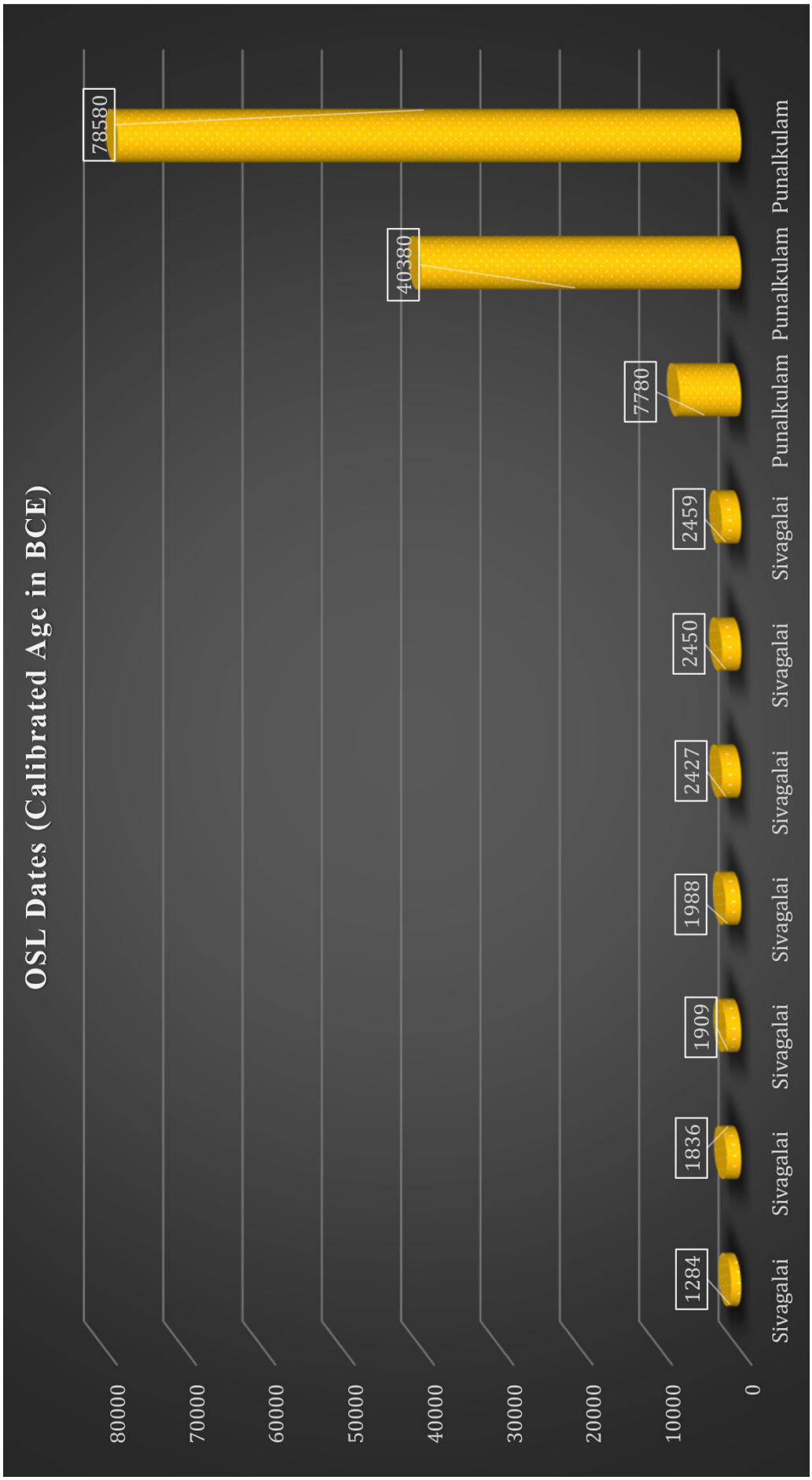

Chart 3: OSL dates for Iron Age and Palaeolithic sites

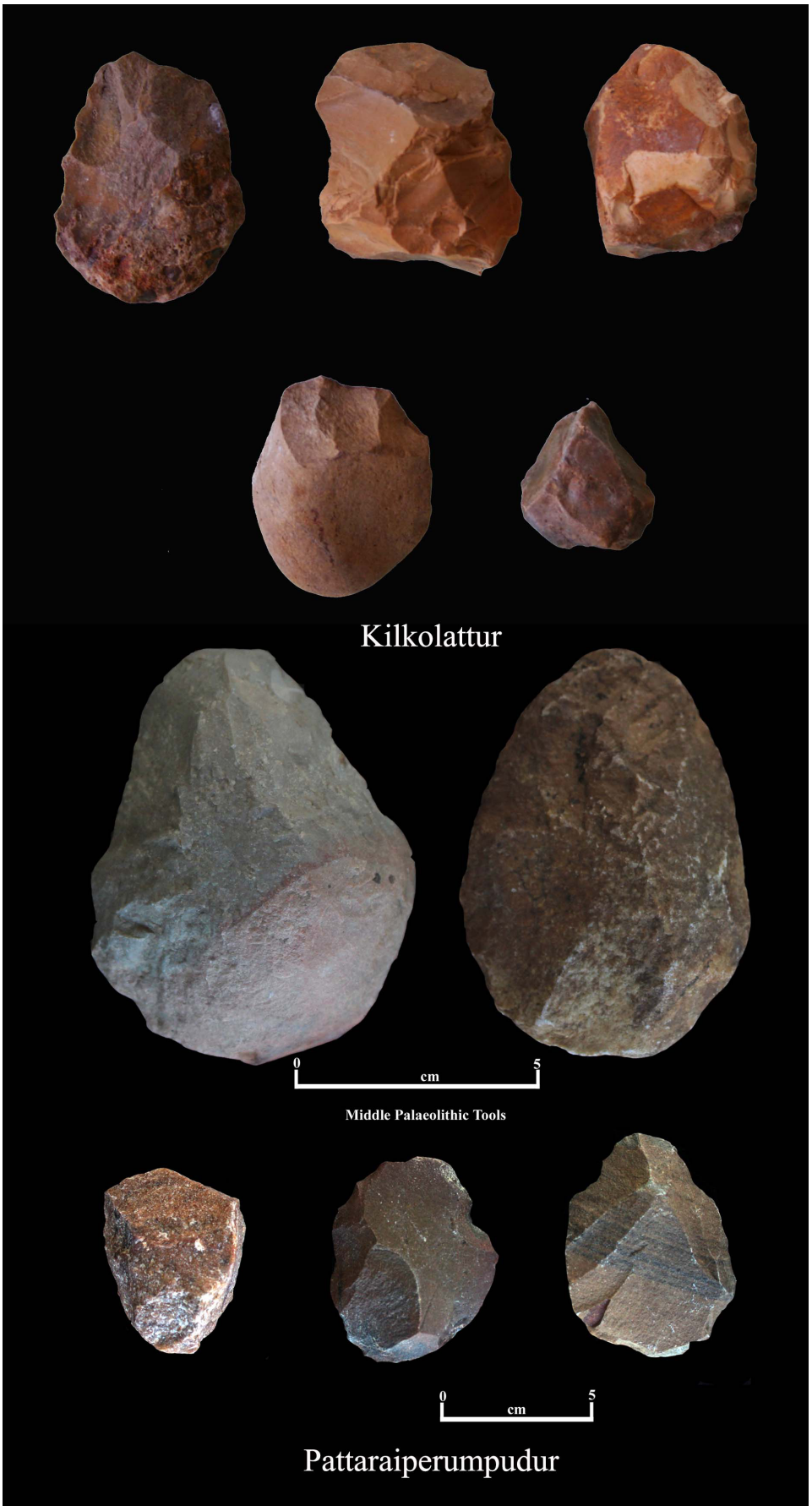

Fig. 3: Middle Palaeolithic tools

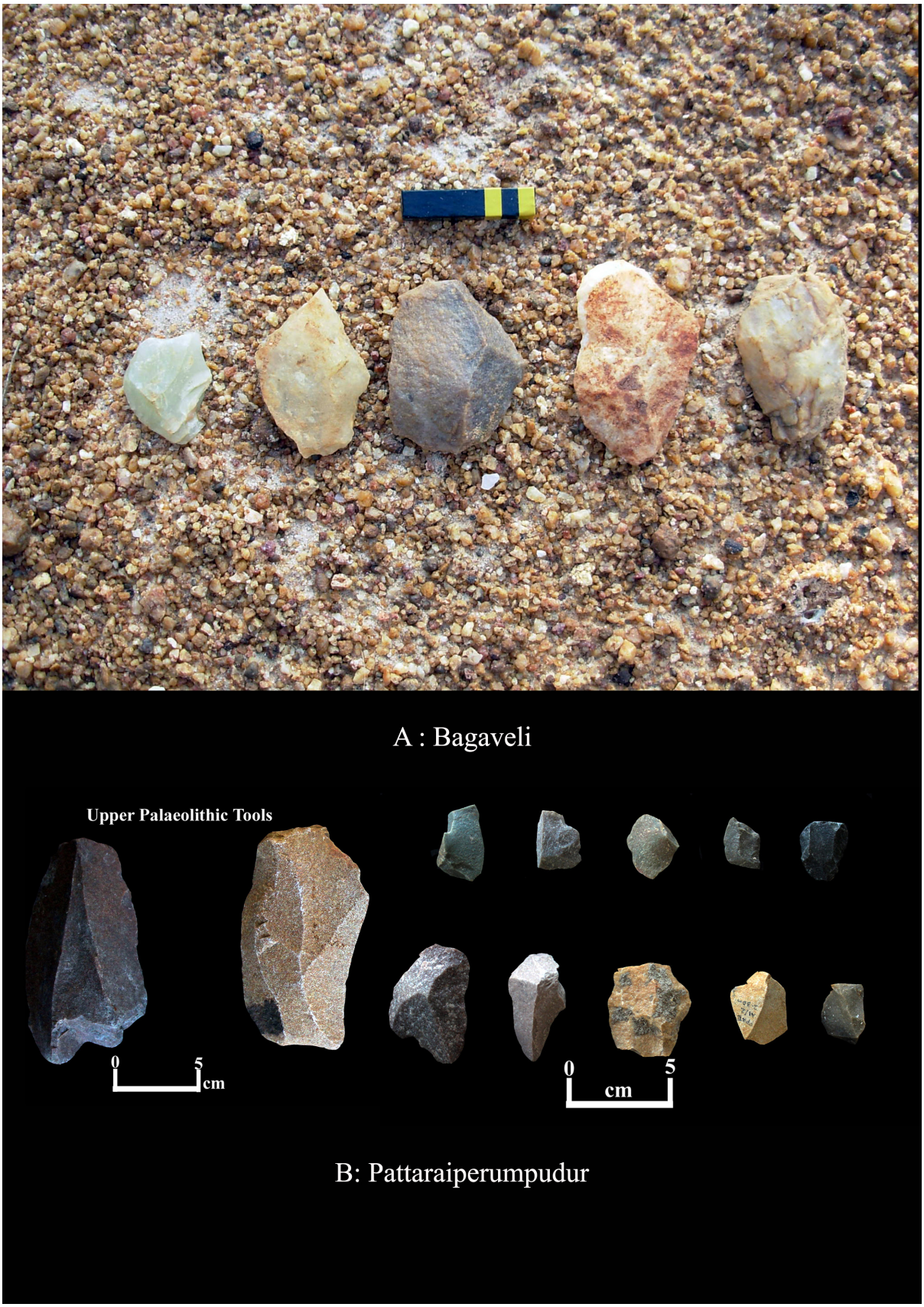

Fig. 4: Upper Palaeolithic tools

OSL date of 10.47±0.85ka obtained in the stratigraphical context of the transitional phase from Microlithic to Neolithic at Chennanur in Krishnagiri district of Tamil Nadu provided a clue on the date of the late phase of the Microlithic period in Tamil Nadu (Fig. 5). The significant feature of this cultural transformation is that the Neolithic phase is witnessed in northern Tamil Nadu after the Microlithic phase (Chart 4). In contrast, in southern Tamil Nadu, the Neolithic phase is almost absent and the culture phase moved from Microlithic to Iron Age, bypassing the Neolithic phase. Thus, the beginning and termination of the Microlithic phase of each cultural/geographical zone have yet to be determined, with a greater number of scientific dates.

Neolithic Culture

Due to limited explorations and excavations, Tamil Nadu witnessed limited information on early agro-pastoral communities. However, the recent identification of celt-making production centres at Kappalavadi, Varattanapalli and Kilnamandi in association with a large number of sites with grinding grooves used for celt sharpening found close to the perennial ponds demonstrates the very existence of the Neolithic phase (Narasimhaiah 1980, Rajan 1997; Gnanaraj 2023). The recent excavations conducted at Myiladumparai, Kilnamandi, Molapalayam, Valasai, and Chennanur provided some clues on the nature of the Neolithic phase (Rajan et.al. 2022; Selvakumar 2021; Soundararajan 2020; Gnanaraj 2023) (Table 3 and 4; Chart 5).

The absence of radiometric dates prevented us from arriving at a definite time range. The declaration of a site as Neolithic based on a single cultural item, namely a celt, irrespective of its continuity in the Iron Age, places the findings in ambiguity. The diverse interpretations of associated ceramics and lithics also make the Neolithic phase an unclear cultural context. This contrasts with the neighbouring southern states, where the Neolithic phase is explicitly established. The well-researched Sankanakallu-Kupgal complex in Karnataka could be cited as the best example (Korisettar 2014). Irrespective of these deficiencies in the identification and interpretations of Neolithic settlements in the north-western part of Tamil Nadu, the recent excavations conducted at Mayiladumparai and Chennanur (Figs. 6-7) and the identification of potential Neolithic tool manufacturing centres at Kappalavadi and Varattanapalli in Krishnagiri district and at Kilnamandi in Tiruvannamalai district and the presence of grinding grooves noticed at more than 30 sites clearly proved the existence of Neolithic settlements.

One could see three stages of tool manufacturing, using reduction sequences. In the first stage, the large dolerite blocks were flaked out of dolerites sourced from existing dykes and in the second stage, large flakes were removed to get the desired blank or preforms and in the third stage, the blank was unifacially flaked and bilateral with one edge having a greater degree of flaking than the other. These initial stages of production were carried out at the raw material yielding locations. The grinding grooves noticed close to the Neolithic settlements

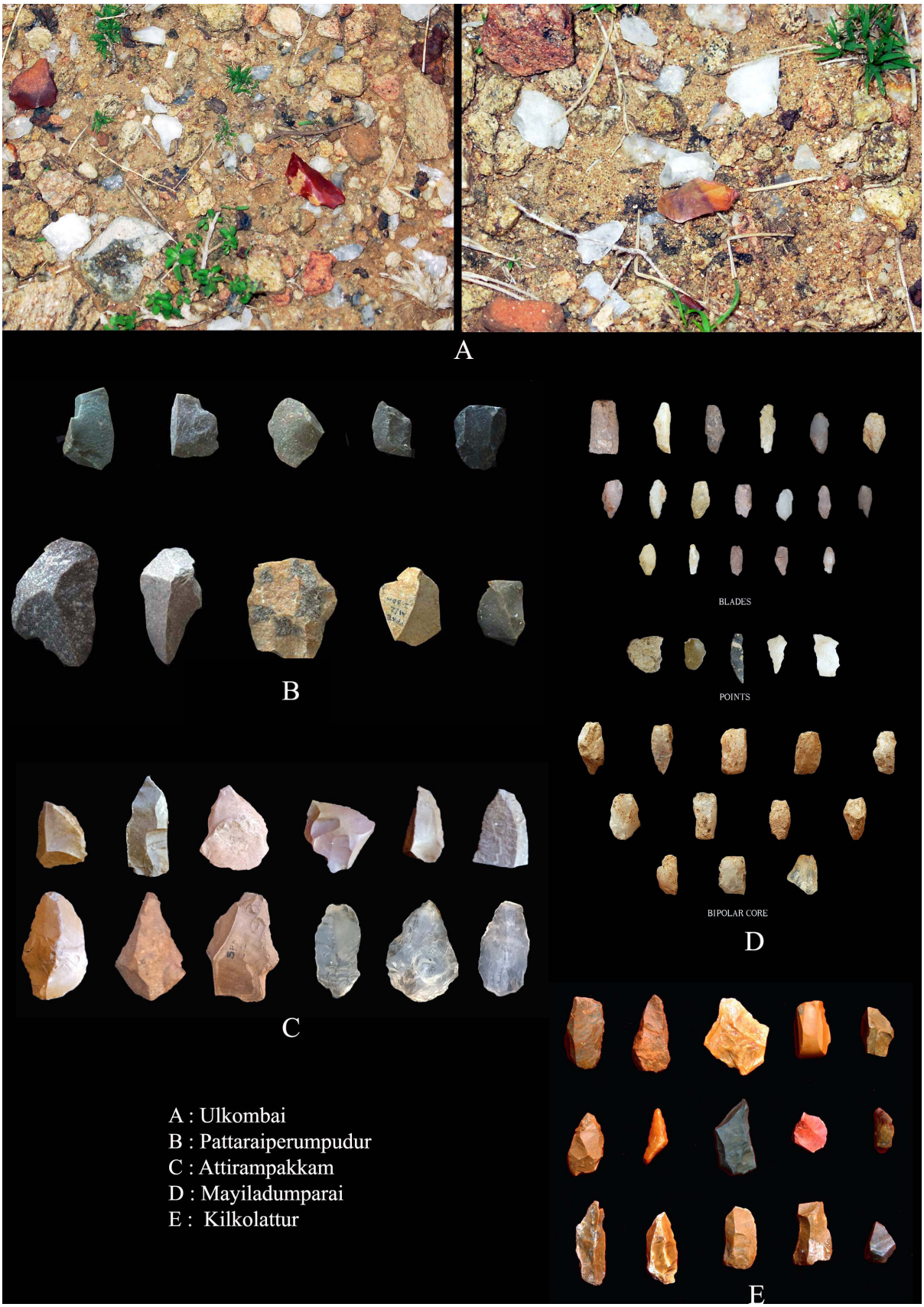

Fig. 5: Microlithic tools

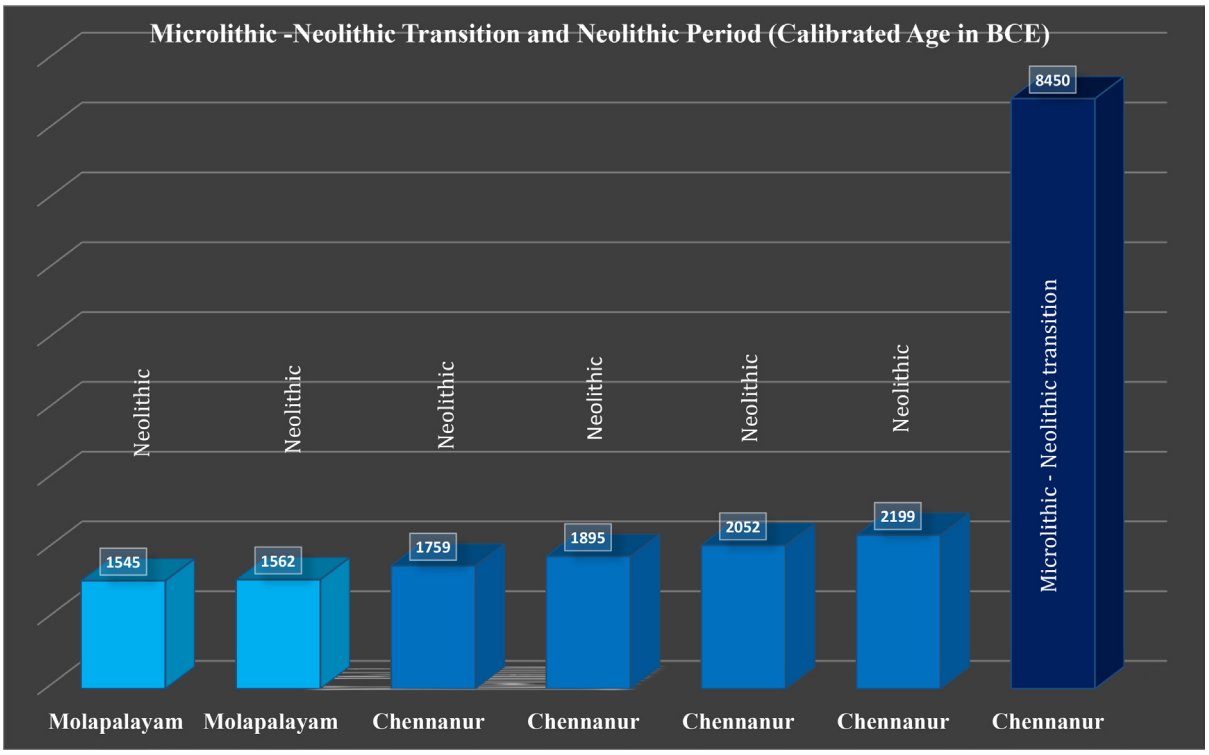

Chart 4: Neolithic and Neolithic-Microlithic transition

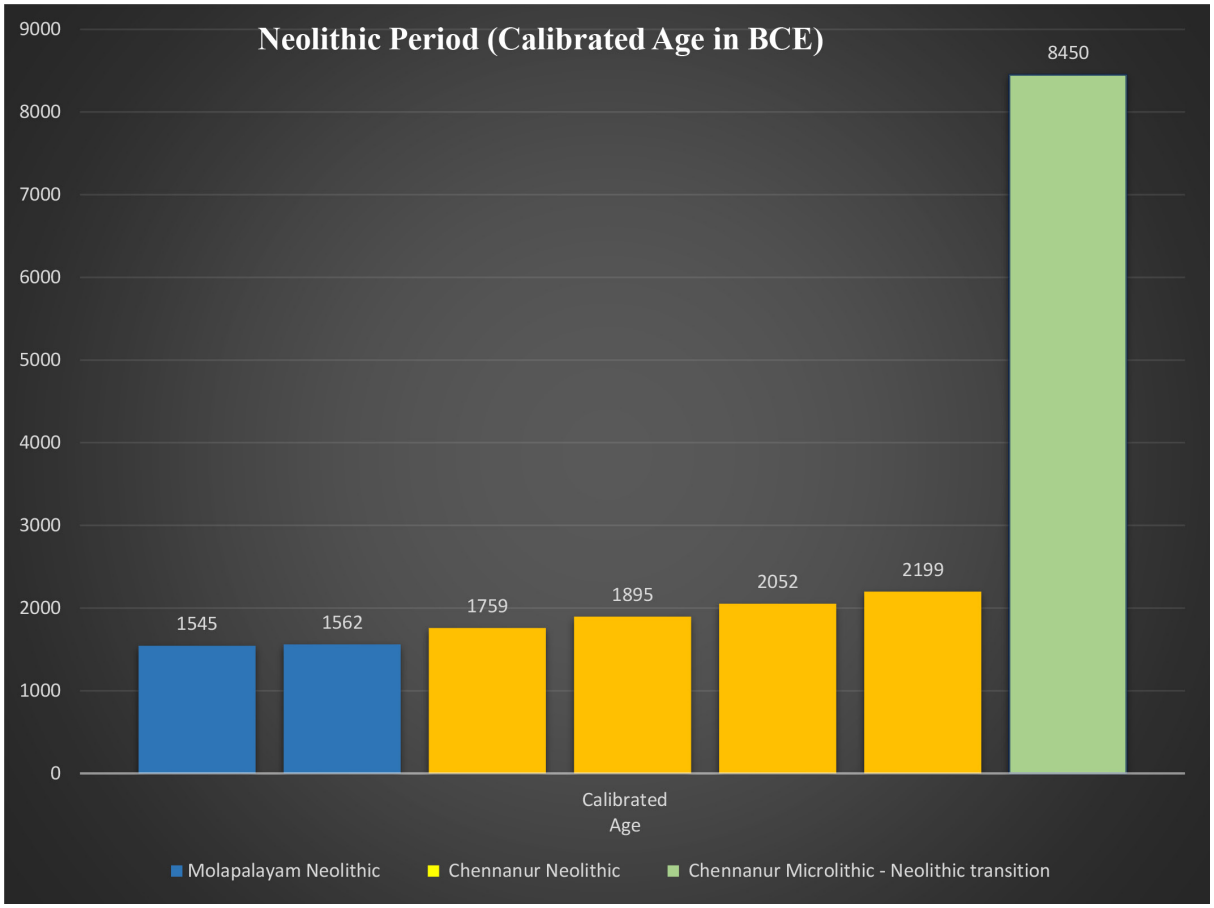

Chart 5: Neolithic sites of Tamil Nadu with scientific dates

Fig. 6: Neolithic tool making factory sites

Fig. 7: Neolithic sites

with water bodies indicate that the final grounding and polishing were carried out close to the settlement itself. The availability of a large number of flakes and unfinished tools observed at Mayiladumparai, Varattanapalli and Kilnamandi stands for the flaking and the remaining several sites with evidence of grinding grooves suggest the grounding and polishing stages of production. The AMS dates of 2142 BCE obtained for the Iron Age cultural level at Mayiladumparai and 3345 BCE at Sivagalai indicate the existence of a Neolithic settlement in Tamil Nadu is prior to the contemporary Neolithic culture in the neighbouring sites of the Karnataka region (Rajan and Sivanantham 2025). The introduction of iron implements might have led to the limited use of Neolithic tools, but they continued to be used during the Iron Age as a part of rituals or as distant memories.

Iron Age

In South India, the culture that precedes the Early Historic and succeeds the Microlithic/ Neolithic is designated with different terms like Proto-Historic culture, Black and Red Ware culture, Megalithic culture or Iron Age culture without any chronological, spatial or cultural control. There is no specific chronological demarcation line between the Iron Age and Megalithic culture or between the Iron Age and Early Historic period. The term Iron Age or Megalithic culture is used interchangeably for a type of mortuary practice that prevailed in this region prior to Early Historic times. However, the sepulchral monuments continued till the end of Early Historic times. The occurrence of Tamili inscribed potsherds from a transepted cist found at Kodumanal and Porunthal and from an urn burial at Marungur near Vadalur are the finest indicators of its continuity in Early Historic times (Rajan 2016; Rajan and Sivanantham 2025). We need to differentiate the Iron Age megalithic monuments from the Early Historic megalithic monuments based on chronological, stratigraphical and cultural evidence. Now, many radiometric dates are available to us to understand the beginning of the Iron Age.

Scholars in India have tried to collect information on the introduction of iron in India through their archaeological excavations over the past several years. Initially, the date of introduction of iron was fixed to 1100 BCE at Hallur in the year 1971 and then to 1300 BCE at Ahar in Rajasthan in the year 1979 and subsequently at Kumaranahalli in Karnataka and Lahuradewa in Uttar Pradesh (Nagaraja Rao 1971; Sahi 1979; Agrawal and Joshi 1990; Tewari 2002). The four radiometric dates obtained for the three samples at Bukkasagara in Karnataka placed the earliest iron production at 1620 BCE (Johansen 2014). Then, the date was further pushed back to 1700-1800 BCE in the excavations conducted at Dadpur, Malhar, Raipura in Uttar Pradesh, Gufkral in Jammu and Kashmir and Maski in Karnataka (Tewari 2003). At Brahmagiri (2140-1940 BCE) in Karnataka and Gochibowli (2220 BCE) in Telangana, the date of iron was pushed back further to the early part of the 3rd millennium BCE (Morrison 2005; Thomas et.al., 2008).

The recent excavations conducted at Adichanallur and Sivagalai tilted the hitherto held view on the antiquity of iron. The samples collected in the cultural context yielding iron objects at Sivagalai were dated using two different scientific methods (13 AMS^{14}C and 7 OSL) from five different scientific laboratories namely Beta Analytic Lab., Arizona University Lab., Inter University Accelerator Centre (IUAC, New Delhi), Birbal Sahni Institute of Palaeosciences (BSIP, Lucknow) and Physical Research Laboratory (PRL, Ahmedabad) that provided the date between 2427 BCE and 3345 BCE (Figs. 8-10; Chart 6). Suppose one considers the absolute dates received from five different laboratories and uses two different techniques, namely AMS^{14}C and OSL. In that case, it is quite clear that the introduction of iron in India goes back to the last quarter of the 3rd millennium BCE. The 2500-3000 BCE date has been taken as a mid-range value, although two dates fall even in the early part of the 4th millennium BCE (3259 BCE and 3345 BCE) (Rajan and Sivanantham 2025).

Thus, the AMS dates obtained for samples collected from the graves at Kilnamandi, Mangadu, Thelunganur, Mayiladumparai, Adichanallur and Sivagalai yielded important AMS and OSL dates that provide a clue for understanding the introduction of iron and also the transformation from the late Neolithic Phase to the Early Iron Age (Rajan et.al., 2022; Rajan et.al., 2017; Arun Raj et al., 2023; Rajan and Sivanantham, 2025) (Table 5-7; Chart 7-9). The recent scientific dates further suggest that the Copper Age of North India and the Iron Age of South India are probably contemporary. Future excavations and scientific dates may further clarify or strengthen the nature of the introduction of iron in India. Nevertheless, the introduction of iron is considered one of the most important technological innovations in human history. The introduction of iron helped the ancient people to bring unproductive lands into cultivable lands, allowing them to increase agricultural production. The surplus agricultural production led to population growth and art and culture paved the way for the emergence of the Early Historic period.

The beginning of rice cultivation is also an important development in the Iron Age. The use of graffiti suggests some symbolic advancement and clan and lineage formations. The graffiti linkage with Harappan symbols requires closer studies and intensive explorations, excavations, and documentation.

Co-existence of the Neolithic culture in the Iron Age

The recent AMS dates from the sites of Molapalayam, Chennanur and Sivagalai and other settlements reveal that Neolithic agro-pastoralism continued when the Iron Age experienced a well-developed stage. Paiyampalli and Molapalayam have given dates in the range of 2000-1400 BCE for the Neolithic culture. While some settlements had pastoral ways of life, iron-using communities existed in some contexts from about the third millennium BCE onwards.

Fig. 8: Sivagalai: Iron Age urn burials and artefacts

Fig. 9: Iron Age urn burials

Fig. 10: Iron Age chamber tombs

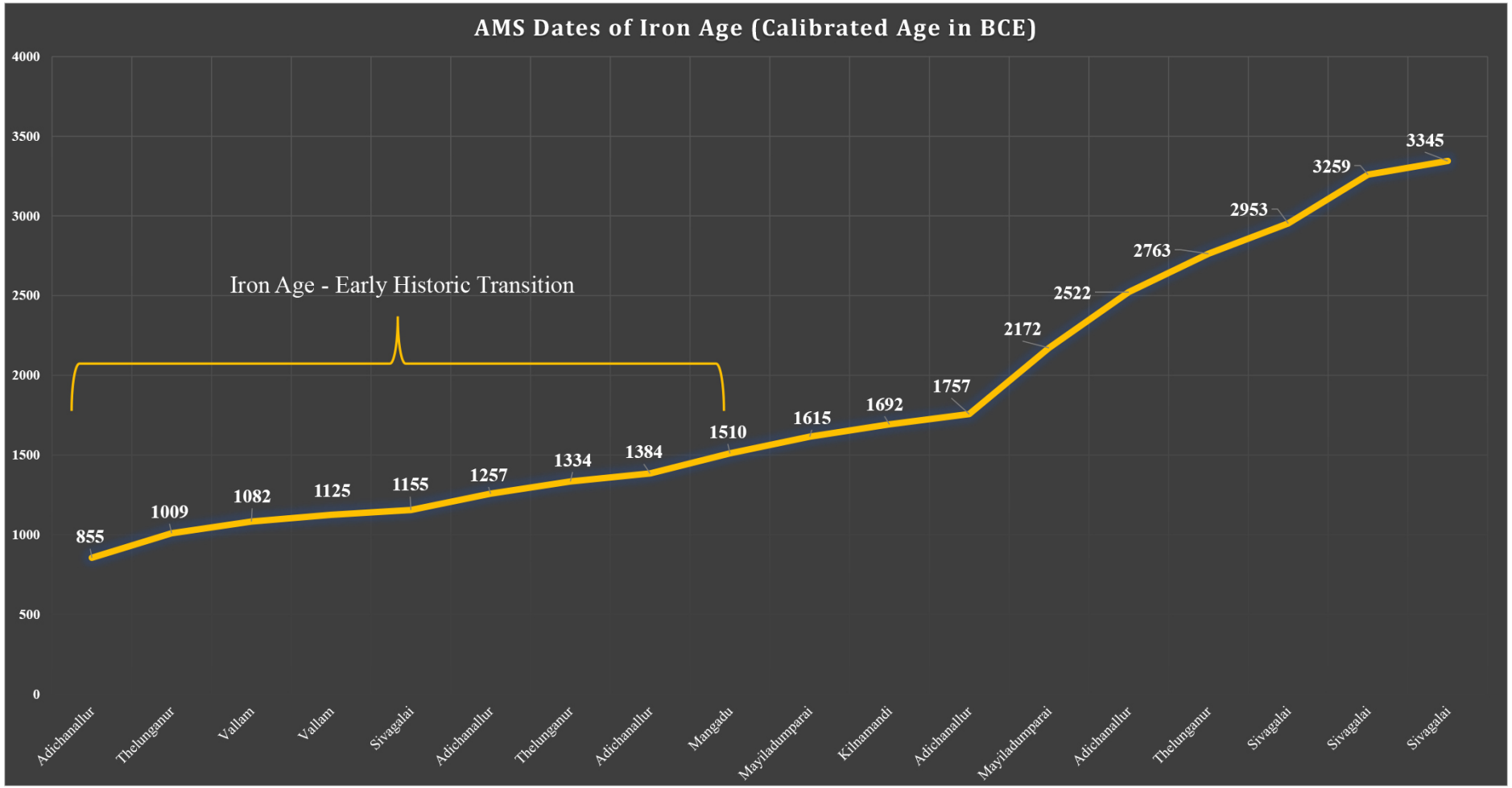

Chart 6: Iron Age sites of Tamil Nadu

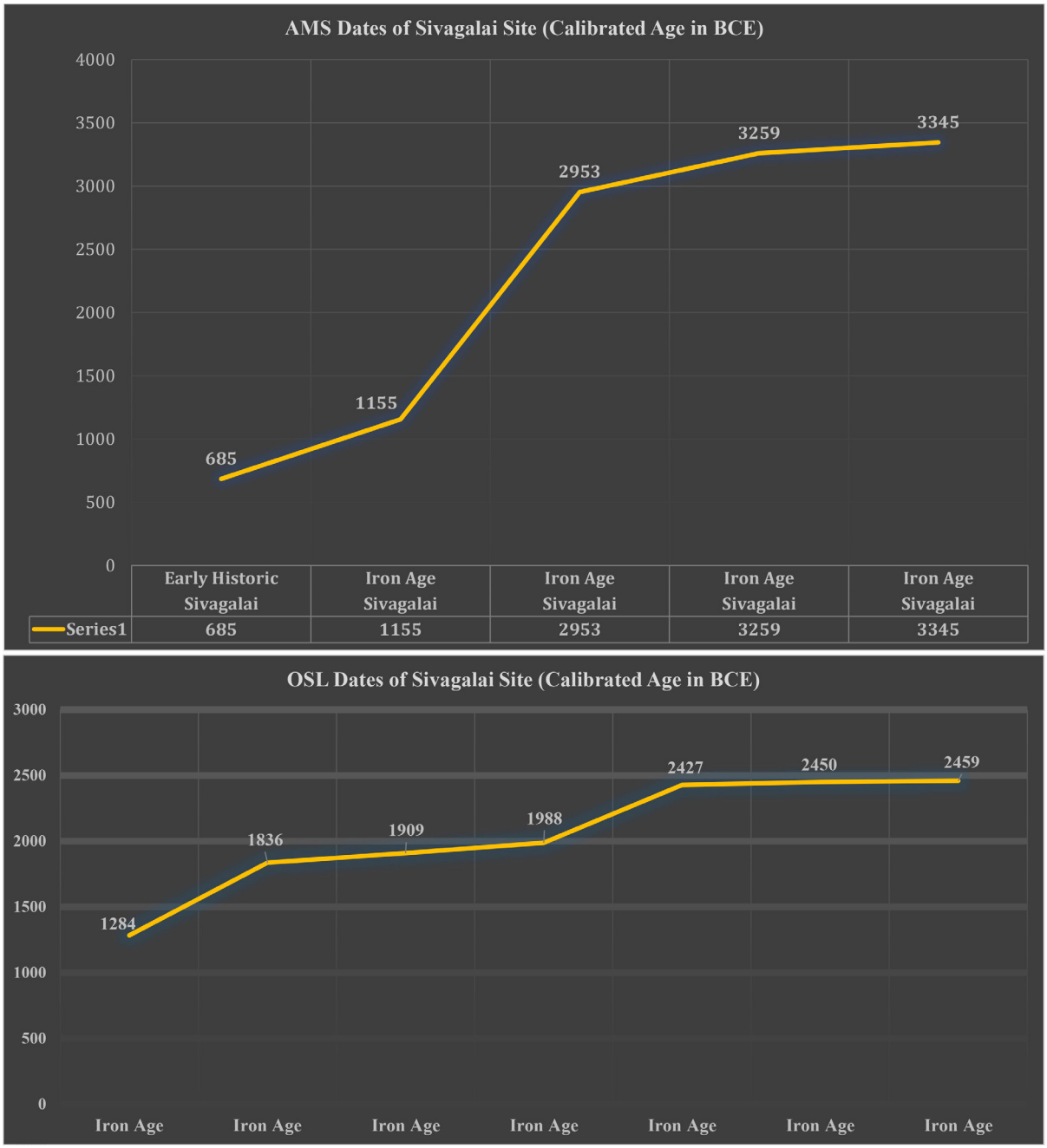

Chart 7: AMS and OSL dates from Sivagalai for the Iron Age

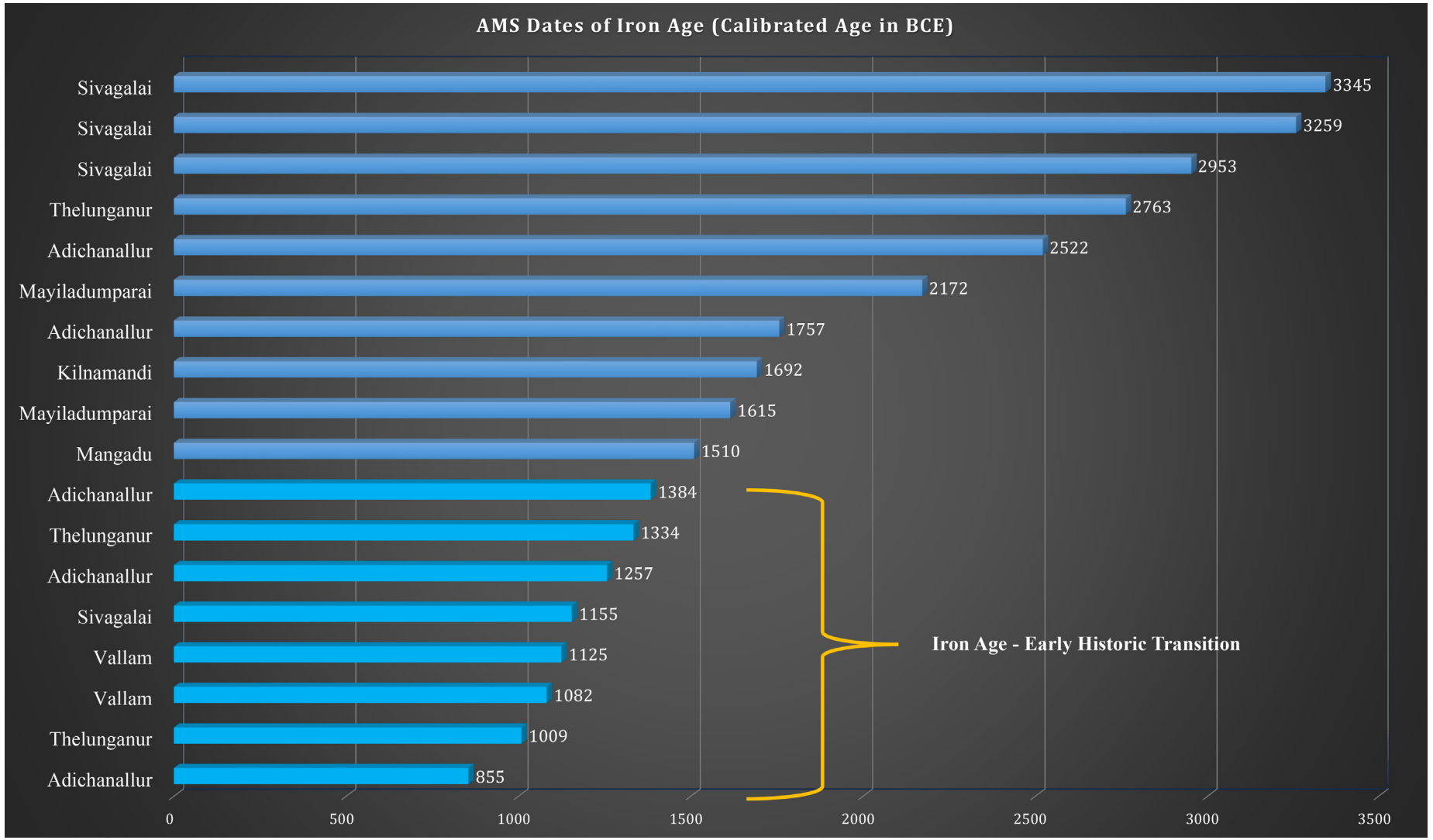

Chart 8: Scientific dates of Iron Age and Iron Age-Early Historic transition

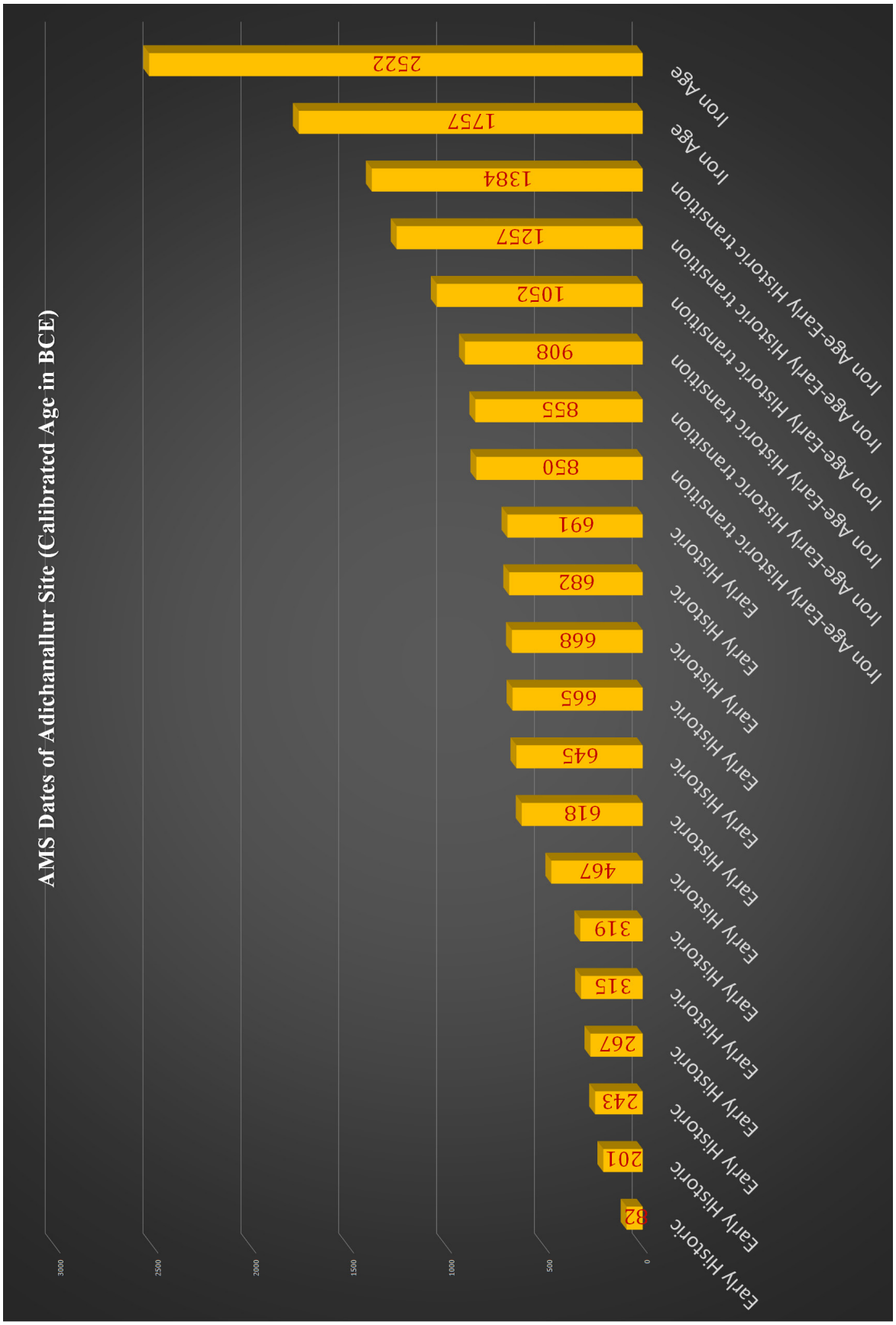

Chart 9: AMS dates for the Iron Age-Early Historic transition and Early Historic Period

The Transition from the Iron Age to Early Historic

At present, the vast time bracket covering the period between 3500 BCE and 700 BCE is designated as the Iron Age. The appearance of the Tamili script in the 7th-6th century BCE is considered the beginning of the Early Historic period. The limited scientific dates constrained scholars further to divide the Iron Age into Early, Middle and Late. The recent AMS dates give a clue to the possibility of dividing the Iron Age into three sub-cultural phases. The excavations conducted at Sivagalai, Mayiladumparai, Adichanallur, Thirumalapuram, Thulukkarpatti, Kilnamandi and Thelunganur provided some clues on the existence of sub-cultural phases. As discussed above, the Early Iron Age phase was witnessed at Sivagalai. The beginning of paddy cultivation, the usage of graffiti, the introduction of high-tin bronzes, the introduction of gold, white painted black-and-red ware, and the presence of primary burials could be considered as the middle phase of the Iron Age, as evidenced at Adichanallur and Thirumalapuram. The large-scale production of paddy, the introduction of steel, wider usage of graffiti marks, the emergence of clan-based society and lineage formations could be considered as the late phase or Iron Age, as evidenced at Thulukkarpatti and Thelunganur. The late phase of the Iron Age can also be equated with the transition stage from the Iron Age to the Early Historic. The future excavations supported with scientific dates may provide a clear understanding of the nature of the transition.

The beginning of the Early Historic Period

The term "Early Historic" in the archaeological context is not uniform and it has been used loosely on several occasions. Further, the term Early Historic is substituted or equated with terms such as Mauryan, Sunga, Satavahana, Sangam Age, etc., with overtones of political authority rather than social process. In a few cases, potsherds such as NBPW, Rouletted ware or Brahmi inscribed potsherds are considered sufficient to designate the culture as Early Historic.

Likewise, establishing the historicity of great personalities such as Mahavira and Buddha is considered adequate to designate the culture as Early Historic. In some instances, domestic architecture, city planning, construction of secular and religious monuments, use of writing, coinage, the introduction of Buddhism or Jainism and external maritime contacts are considered the beginning of the Early Historic period. The above arguments suggest that there is no consensus among archaeologists. The evidences embedded in epigraphical, numismatic, literary and archaeological records clearly point to the emergence or formation of a new social order hitherto unnoticed in the previous Iron Age culture. The occurrence of bronze objects, carnelian and agate beads in the Iron Age context, well before the traces of NBPW and Punch Marked coins, suggests that South India had long-distance trade well before the so-called Mauryan incursion in Andhra Pradesh and Karnataka.

Irrespective of this emerging scenario, the majority of the early historic sites in South India date back to the 3rd century BCE. The reason for assigning such a date is based on the assumption that the Brahmi script was introduced in South India after Asoka. Though several parameters, such as trade, technology, architecture, political authority, territorial integrity, urbanisation, etc., are available to designate culture as Early Historic, the occurrence of the Brahmi script is considered the beginning of the Early Historic period in South India. So, the date of Brahmi became crucial in understanding the Early Historic context.

To date, the date of the Brahmi script was generally determined based on stratigraphy, palaeography, orthography, linguistic features, internal historical evidence and other external cultural/trade contacts. In Tamil Nadu, nearly 1572 Tamili inscribed potsherds have been documented to date from 79 Early Historic sites. The recent archaeological excavations at Tamili yielding sites, particularly at Porunthal, Kodumanal, Keeladi and Alagankulam, provided 89 radiometric dates (Rajan et.al., 2021). Of the 89, more than 50% of them were assigned to Pre-Asokan, and the earliest date goes back to the 6th century BCE (Table 8-10; Chart 10-12). Thus, the beginning of the Early Historic period in South India could be securely placed in the 6th century BCE, as contemporary to the Mahajanapadas of the Gangetic valley. The availability of extensive brick structures, the evidence of internal, external and maritime trade contacts evidenced from the occurrence of beads of Carnelian, Agate, Lapis lazuli, Sri Lankan Cat eye, NBPW, Punch-Marked coins, Amphorae, Arretine, Indo-Pacific monochrome Glass beads, names of Prakrit origin, the development of copper, iron, steel, textile, conch and pearl technology, the availability of inscribed coins and seals, formation of trade routes and many other cultural items with technological achievements demonstrate that south India, particularly Tamil Nadu, entered into the Early Historic phase in 6th century BCE as demonstrated by the recent radiometric dates (Figs. 11-12).

Based on recent Cosmogenic Nuclide, OSL, and AMS dates, one could witness the cultural transformations that were encountered in Tamil Nadu from the time of the Lower Palaeolithic down to the Early Historic, covering the period from around 1.7 Ma to the 3rd century CE (Chart 13-14). Keeping in view of the accuracy provided by the primary sources such as inscriptions, copper plates, literature, numismatic evidences and foreign accounts, the scientific dates are not generally preferred in Historical period. However, the samples collected from Vembakottai were dated which provided the scientific dates to the Historical period (Table 11). The availability of a large number of epigraphical records with precise dates issued subsequently during the reigns of Pallavas, Pandyas, Cholas, Vijayanagars, Nayaks, and the Colonial period provided a comprehensive picture of the chronological scale.

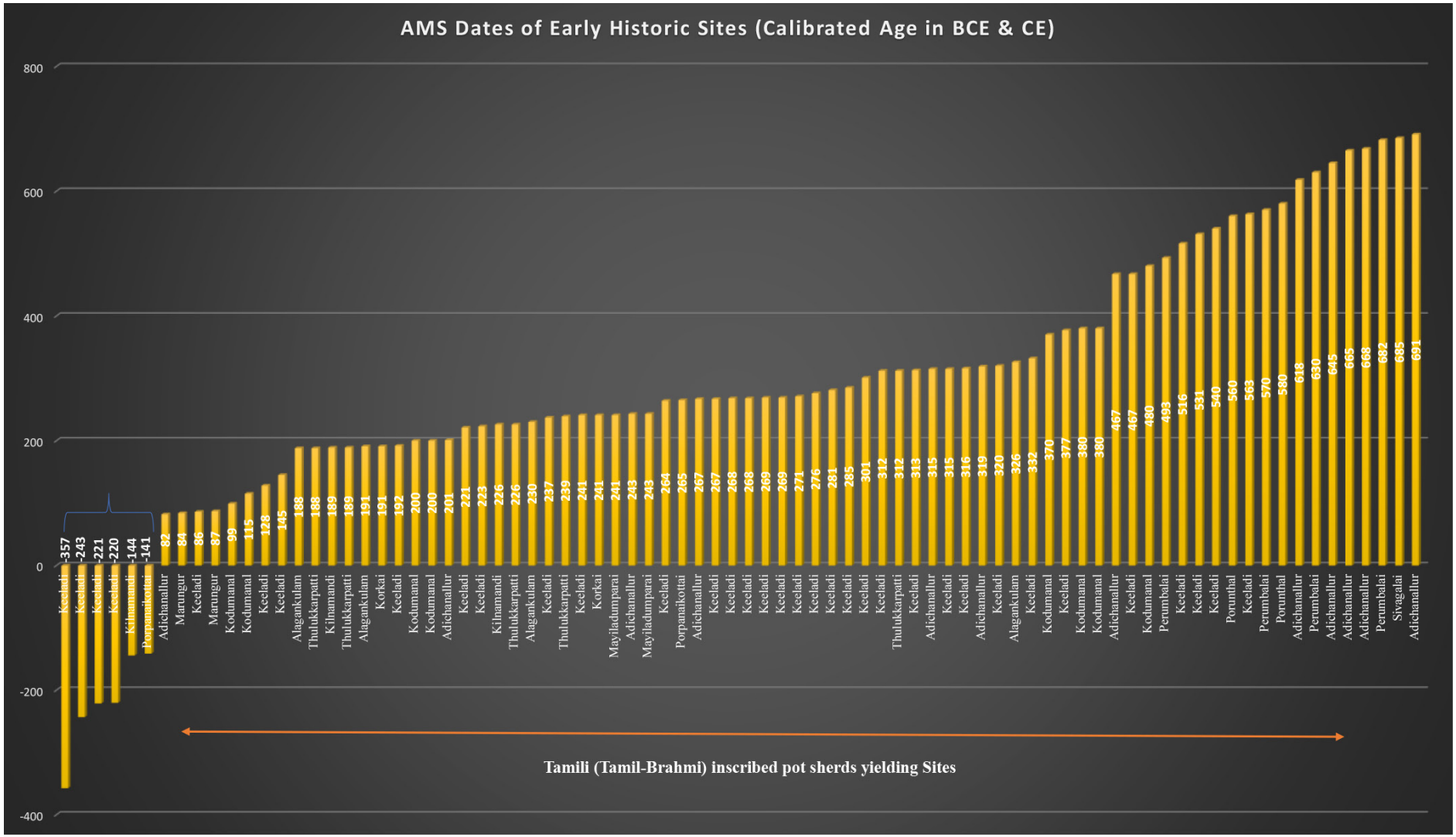

Chart 10: AMS dates of Early Historic Period

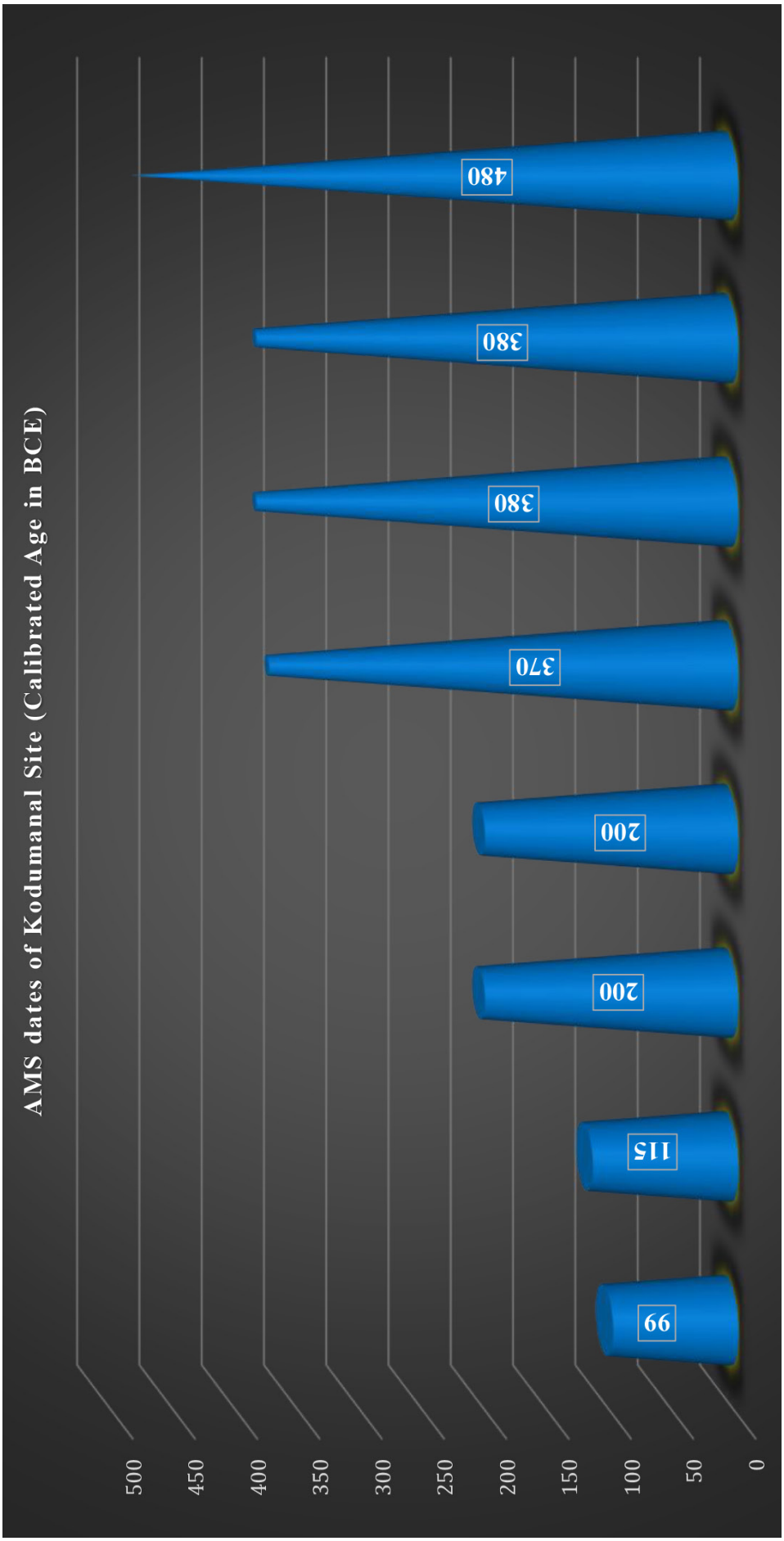

Chart 11: AMS dates from Early Historic (Sangam Age) site Kodumanal

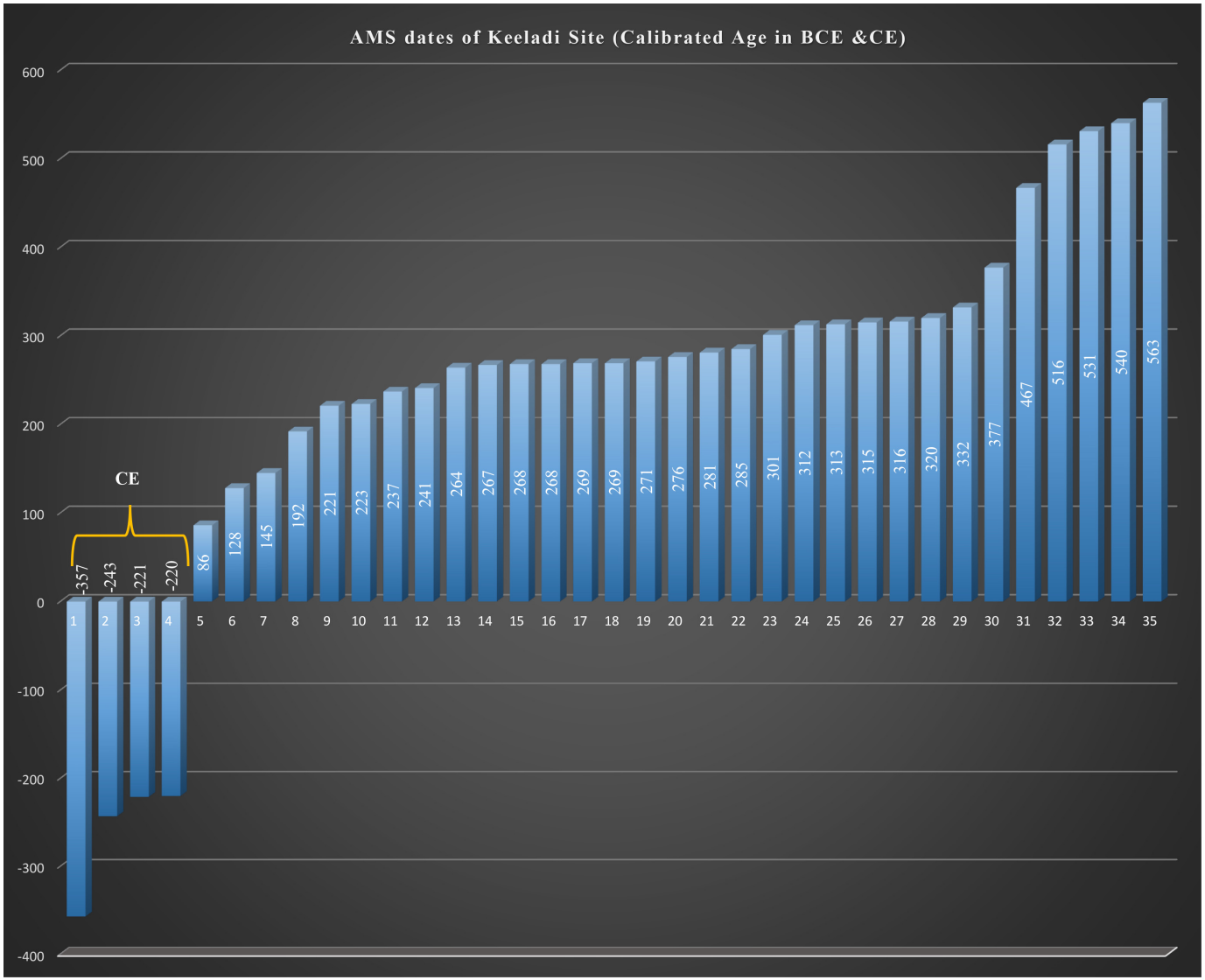

Chart 12: AMS dates from Early Historic (Sangam Age) site Keeladi

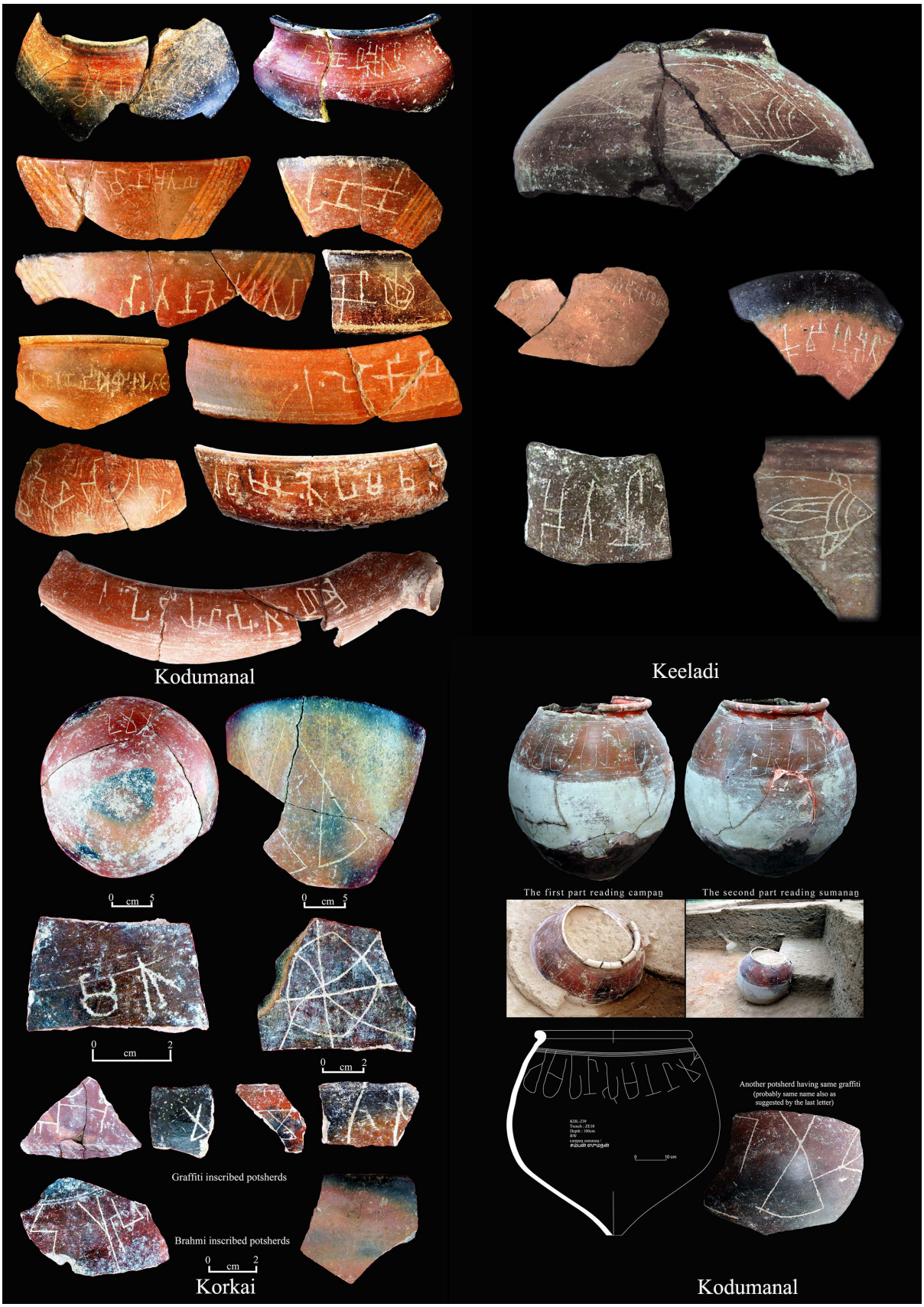

Fig. 11: Tamili (Tamil-Brahmi) inscribed potsherds

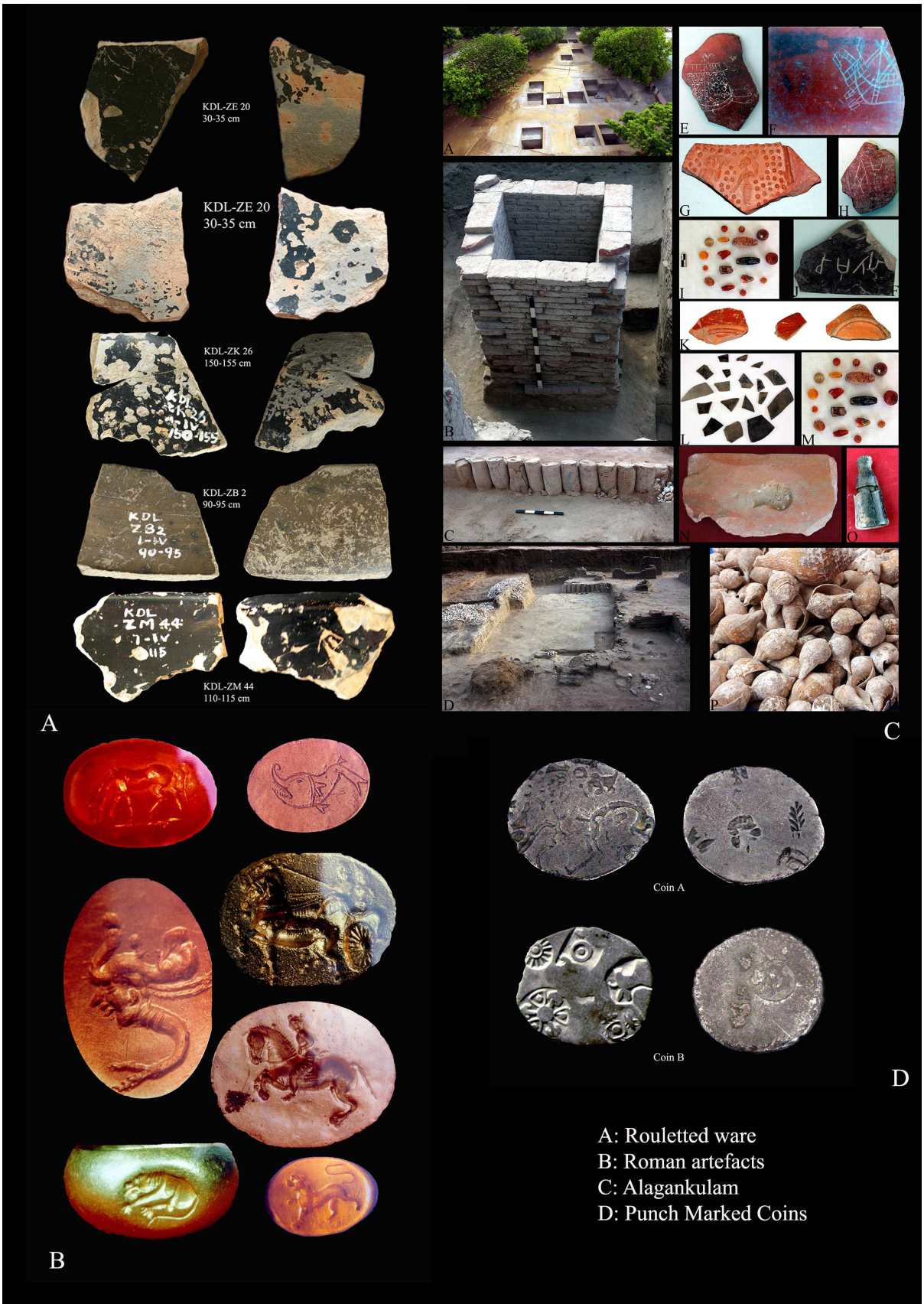

Fig. 12: Early Historic artefacts

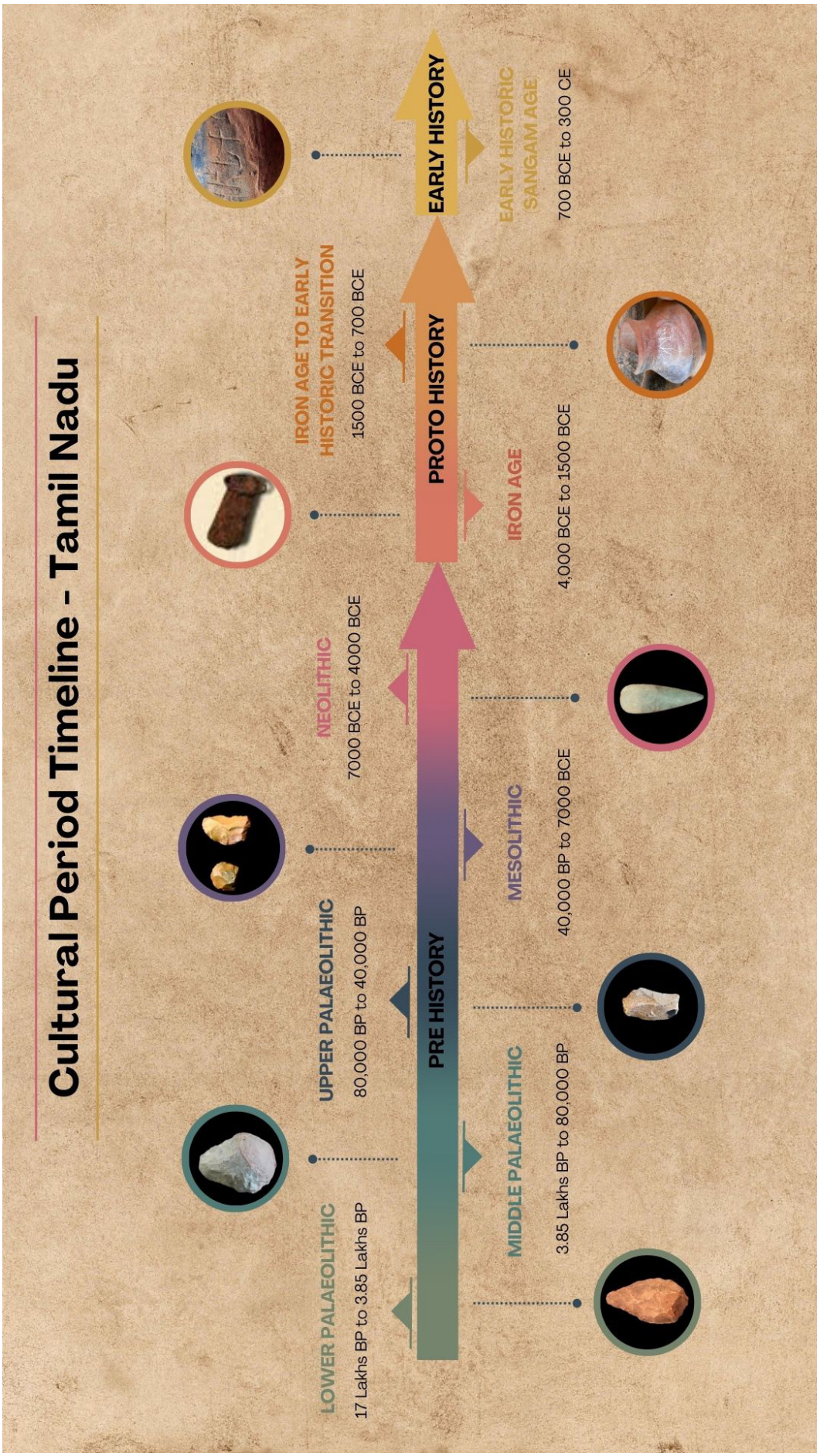

Chart 13: Timeline for various Cultural Periods based on Cosmogenic Nuclide, Palaeomagnetic Measurements, Luminescence, OSL and AMS dates

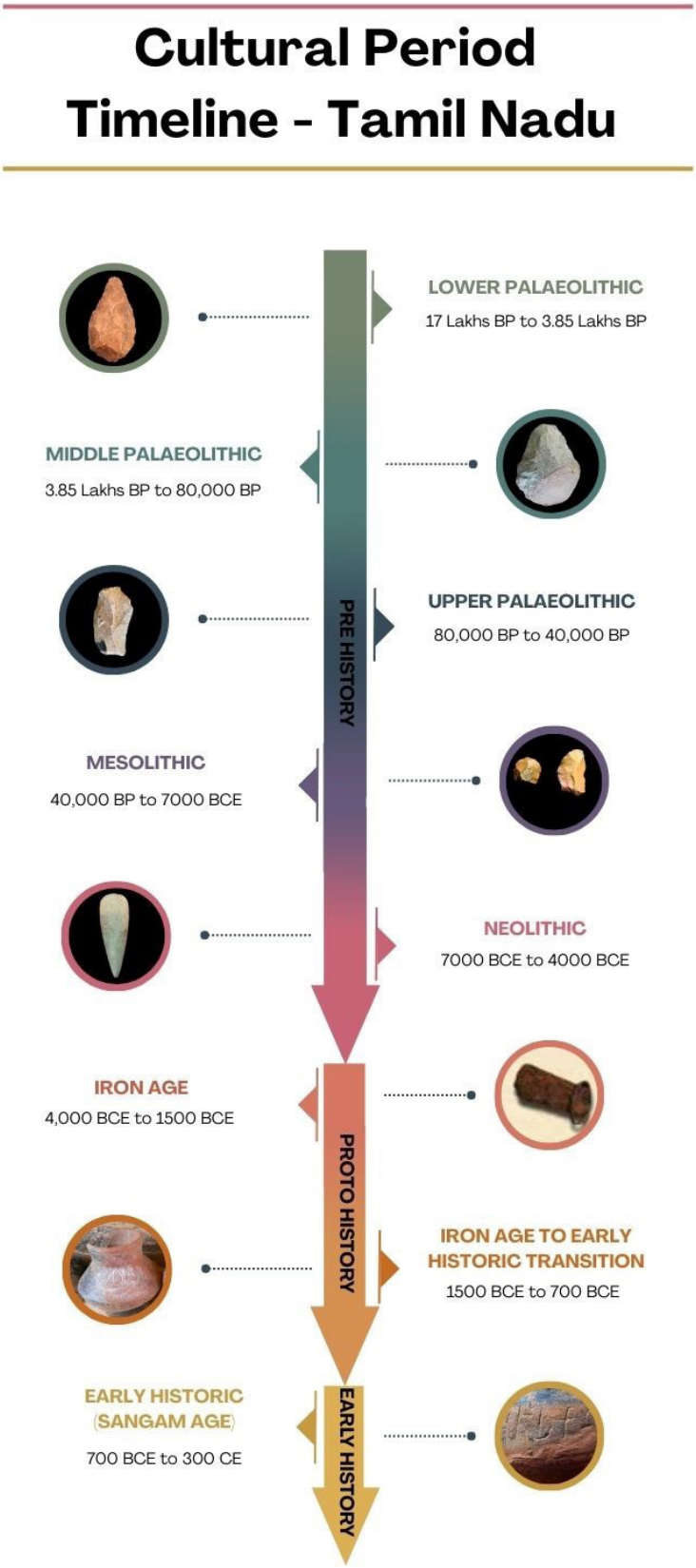

Chart 14: Timeline for various Cultural Periods based on scientific dates

Tables

Table 1: AMS dates for the Archaeological Sites of Tamil Nadu

S. No.	Site	Institution	Laboratory No.	Trench/ Layer/ Depth	Conventional Age in BP	Conventional Age	Calibrated Age	Clutural Period
1	Keeladi	TNSDA	Beta - 620260	YP4/136 cm	1750±30	200 CE	357 CE	Early Historic
2	Keeladi	TNSDA	Beta - 583573	YD3/1/575 cm	1850±30	100 CE	243 CE	Early Historic
3	Keeladi	TNSDA	Beta - 583571	YD3/1/400 cm	1810±30	140 CE	221 CE	Early Historic
4	Keeladi	TNSDA	Beta - 583572	YD3/1/520 cm	1820±30	130 CE	220 CE	Early Historic
5	Kilnamandi	TNSDA	Beta - 759200	Z84	1900±30	50 CE	144 CE	Early Historic
6	Porpanaikottai	TNSDA	Beta - 759189	B1	1880±30	70 CE	141 CE	Early Historic
7	Adichanallur	TNSDA	Beta - 583588	1/L-2/A1/4	2020±30	70 BCE	82 BCE	Early Historic
8	Marungur	TNSDA	Beta - 759206	ZB1	1990±30	40 BCE	84 BCE	Early Historic
9	Keeladi	TNSDA	Beta - 620261	YP4/168 cm	2000±30	50 BCE	86 BCE	Early Historic
10	Marungur	TNSDA	Beta - 759205	A1	1950±30	0 BCE	87 BCE	Early Historic
11	Kodumanal	TNSDA	Beta - 583599	XC16/4	2090±30	140 BCE	99 BCE	Early Historic
12	Kodumanal	TNSDA	Beta - 583598	XC16/4	2030±30	80 BCE	115 BCE	Early Historic
13	Keeladi	ASI	Beta - 521460	YF1/1/145 cm	2090±30	140 BCE	128 BCE	Early Historic
14	Keeladi	TNSDA	Beta - 519481	A3/4/347 cm	2140±30	190 BCE	145 BCE	Early Historic
15	Alagankulam	TNSDA	Beta - 494630	ZC3/4/90 cm	2030±30	80 BCE	188 BCE	Early Historic
16	Thulukkarpatti	TNSDA	Beta - 759194	YD21	2170±30	220 BCE	188 BCE	Early Historic
17	Kilnamandi	TNSDA	Beta - 759201	Z84	2180±30	230 BCE	189 BCE	Early Historic
18	Thulukkarpatti	TNSDA	Beta - 759195	YF23	2180±30	230 BCE	189 BCE	Early Historic
19	Alagankulam	TNSDA	Beta - 494633	YD7/4/138 cm	2170±30	220 BCE	191 BCE	Early Historic
20	Korkai	TNSDA	Beta - 640450	V17/3/190 cm	2180±30	230 BCE	191 BCE	Early Historic
21	Keeladi	ASI	Beta - 489244	YG4/NW	2170±30	220 BCE	192 BCE	Early Historic
22	Kodumanal	Pondicherry University	Beta - 351053	KDL/ZD20/15 cm	2150±30	200 BCE	200 BCE	Early Historic
23	Kodumanal	Pondicherry University	-	P2/4/82 cm	2180±30	210 BCE	200 BCE	Early Historic
24	Adichanallur	ASI	IUACD# 23C5687	L-B/ZB18/IV/44 cm/Charcoal	2163±38	213 BCE	201 BCE	Early Historic
25	Keeladi	TNSDA	Beta - 519478	A3/2/195 cm	1770±30	180 BCE	221 BCE	Early Historic

Table 1: AMS dates for the Archaeological Sites of Tamil Nadu								
S. No.	Site	Institution	Laboratory No.	Trench/ Layer/ Depth	Conventional Age in BP	Conventional Age	Calibrated Age	Clutural Period
26	Keeladi	TNSDA	Beta - 640442	XM9/3/145 cm	2120±30	170 BCE	223 BCE	Early Historic
27	Kilnamandi	TNSDA	Beta - 759202	XBS4	2110±30	160 BCE	226 BCE	Early Historic
28	Thulukkarpatti	TNSDA	Beta - 759193	YF24	2110±30	160 BCE	226 BCE	Early Historic
29	Alagankulam	TNSDA	Beta - 494631	ZC3/4/348 cm	2130±30	180 BCE	230 BCE	Early Historic
30	Keeladi	TNSDA	Beta - 759211	YC3/2	2210±30	260 BCE	237 BCE	Early Historic
31	Thulukkarpatti	TNSDA	Beta - 759192	YF23	2160±30	210 BCE	239 BCE	Early Historic
32	Keeladi	TNSDA	Beta - 640441	XM11/2/140 cm	2160±30	210 BCE	241 BCE	Early Historic
33	Korkai	TNSDA	Beta - 640451	P2/4/82 cm	2160±30	210 BCE	241 BCE	Early Historic
34	Mayiladumparai	TNSDA	Beta - 620257	L-06/K/10/76 cm	1810±30	140 CE	241 BCE	Early Historic
35	Adichanallur	TNSDA	Beta -583590	1/L-2/ZB1/4	2170±30	220 BCE	243 BCE	Early Historic
36	Mayiladumparai	TNSDA	Beta - 620256	L-06/K/10/105 cm	1850±30	100 CE	243 BCE	Early Historic
37	Keeladi	TNSDA	Beta - 519480	A2/1/371 cm	2180±30	230 BCE	264 BCE	Early Historic
38	Porpanaikottai	TNSDA	Beta - 759190	H2	2230±30	280 BCE	265 BCE	Early Historic
39	Adichanallur	TNSDA	Beta - 583587	1/L-2/ZE/4	2190±30	240 BCE	267 BCE	Early Historic
40	Keeladi	TNSDA	Beta - 640443	XM10/2/168 cm	2190±30	240 BCE	267 BCE	Early Historic
41	Keeladi	TNSDA	Beta - 583577	YE6/4/229 cm	2200±30	250 BCE	268 BCE	Early Historic
42	Keeladi	TNSDA	Beta - 759208	YW11/3	2220±30	270 BCE	268 BCE	Early Historic
43	Keeladi	TNSDA	Beta - 519479	A3/2/207 cm	2190±30	240 BCE	269 BCE	Early Historic
44	Keeladi	ASI	Beta - 521462	YB1/3/298 cm	2190±30	240 BCE	269 BCE	Early Historic
45	Keeladi	TNSDA	Beta - 640444	XM13/2/226 cm	2200 ±30	250 BCE	271 BCE	Early Historic
46	Keeladi	ASI	Beta - 521459	YF1/2/85	2200±30	250 BCE	276 BCE	Early Historic
47	Keeladi	TNSDA	Beta - 759207	YU11/3	2270 ±30	320 BCE	281 BCE	Early Historic
48	Keeladi	ASI	Beta - 521458	YE1/2/93 cm	2210±30	260 BCE	285 BCE	Early Historic
49	Keeladi	ASI	Beta - 521461	ZA 1/3/273 cm	2160±30	210 BCE	301 BCE	Early Historic
50	Keeladi	TNSDA	Beta - 620262	YQ5/299 cm	2230±30	280 BCE	312 BCE	Early Historic
51	Thulukkarpatti	TNSDA	Beta - 759191	ZQ11	2240±30	290 BCE	312 BCE	Early Historic
52	Keeladi	TNSDA	Beta - 519477	A2/4/315 cm	2230±30	280 BCE	313 BCE	Early Historic

Table 1: AMS dates for the Archaeological Sites of Tamil Nadu								
S. No.	Site	Institution	Laboratory No.	Trench/ Layer/ Depth	Conventional Age in BP	Conventional Age	Calibrated Age	Clutural Period
53	Adichanallur	ASI	IUACD#23C5686	L-B/ZD17/I/100 cm/Charcoal	2256±38	306 BCE	315 BCE	Early Historic
54	Keeladi	TNSDA	Beta - 583574	YD3/1/333 cm	2270±30	320 BCE	315 BCE	Early Historic
55	Keeladi	ASI	Beta - 489243	YG6/SW	2260±30	310 BCE	316 BCE	Early Historic
56	Adichanallur	ASI	IUACD#23C5696	L-C/ZM46/I/290 cm /Urn 46/Husk of Paddy	2279±47	329 BCE	319 BCE	Early Historic
57	Keeladi	ASI	Beta - 454597	YF4/2/195 cm	2200±30	250 BCE	320 BCE	Early Historic
58	Alagankulam	TNSDA	Beta - 494632	ZC3/4/611 cm	2320±30	370 BCE	326 BCE	Early Historic
59	Keeladi	ASI	Beta - 454596	YF1/1/250 cm	2170±30	220 BCE	332 BCE	Early Historic
60	Kodumanal	Pondicherry University	Beta - 349958	ZD20/65 cm	2250±30	300 BCE	370 BCE	Early Historic
61	Keeladi	TNSDA	Beta - 759209	YW11/2	2490±30	540 BCE	377 BCE	Early Historic
62	Kodumanal	Pondicherry University	Beta - 330303	ZD10/80 cm	2280±30	330 BCE	380 BCE	Early Historic
63	Kodumanal	Pondicherry University	AA - 99856	ZE10/60 cm	2225±41	275 BCE	380 BCE	Early Historic
64	Adichanallur	ASI	IUACD#23C5688	L-B/ZB18/IV/90 cm/Charcoal	2349±39	399 BCE	467 BCE	Early Historic
65	Keeladi	TNSDA	Beta - 583575	YD4/2/356 cm	2380±30	430 BCE	467 BCE	Early Historic
66	Kodumanal	Pondicherry University	AA - 99855	ZE9/120 cm	2358±40	408 BCE	480 BCE	Early Historic
67	Perumbalai	TNSDA	Beta - 640429	L-01/292 cm	2360±30	410 BCE	493 BCE	Early Historic
68	Keeladi	TNSDA	Beta - 583578	YE6/4/300 cm	2400±30	450 BCE	516 BCE	Early Historic
69	Keeladi	TNSDA	Beta - 519476	YP7/4/353 cm	2530±30	580 BCE	531 BCE	Early Historic
70	Keeladi	TNSDA	Beta - 583576	YD4/2/384 cm	2470±30	520 BCE	540 BCE	Early Historic
71	Porunthal	Pondicherry University	Beta - 305904	Meg-IV	2400±35	450 BCE	560 BCE	Early Historic
72	Keeladi	TNSDA	Beta - 583579	YS8/4/350	2490±30	540 BCE	563 BCE	Early Historic

Table 1: AMS dates for the Archaeological Sites of Tamil Nadu

S. No.	Site	Institution	Laboratory No.	Trench/ Layer/ Depth	Conventional Age in BP	Conventional Age	Calibrated Age	Clutural Period
73	Perumbalai	TNSDA	Beta - 640431	L-01/C1/228 cm	2450±30	500 BCE	570 BCE	Early Historic
74	Porunthal	Pondicherry University	Beta - 302854	Meg-I	2440±36	490 BCE	580 BCE	Early Historic
75	Adichanallur	ASI	IUACD#23C5698	L-A/XAS18/II/60 cm/Charred bone	2425±49	475 BCE	618 BCE	Early Historic
76	Perumbalai	TNSDA	Beta - 640430	L-01/IE3/263 cm	2440±30	490 BCE	630 BCE	Early Historic
77	Adichanallur	ASI	Beta - 519499	Urn No.58	2510±30	610 BCE	645 BCE	Early Historic
78	Adichanallur	ASI	IUACD#23C5690	L-B/ZB18/I/155 cm/Urn 4/Husk of Paddy	2512±33	562 BCE	665 BCE	Early Historic
79	Adichanallur	ASI	IUACD#23C5695	L-C/ZM45/IV/155 cm/URN 3/Husk of Paddy	2522±36	572 BCE	668 BCE	Early Historic
80	Adichanallur	ASI	Beta - 519499	Urn No.58	2510±30	560 BCE	682 BCE	Early Historic
81	Perumbalai	TNSDA	Beta - 640432	B3(L-01)	2540±30	590 BCE	682 BCE	Early Historic
82	Sivagalai	TNSDA	Beta - 600727	Habitation	2560±30	610 BCE	685 BCE	Early Historic
83	Adichanallur	ASI	IUACD#23C5691	L-C/ZM45/I/212 cm/Urn 7/Husk of Paddy	2593±34	643 BCE	691 BCE	Early Historic
84	Adichanallur	ASI	Beta - 519500	Urn No.105	2700±31	750 BCE	850 BCE	Iron Age-Early Historic transition
85	Adichanallur	ASI	Beta - 519500	Urn No.105	2700±30	750 BCE	855 BCE	Iron Age-Early Historic transition
86	Adichanallur	ASI	IUACD#23C5694	L-C/ZN45/III/318 cm/Urn 17/Husk of Paddy	2759±33	809 BCE	908 BCE	Iron Age-Early Historic transition

Table 1: AMS dates for the Archaeological Sites of Tamil Nadu								
S. No.	Site	Institution	Laboratory No.	Trench/ Layer/ Depth	Conventional Age in BP	Conventional Age	Calibrated Age	Clutural Period
87	Thelunganur	Pondicherry University	AA - 104113	Arrowhead from a grave	2835±34	885 BCE	1009 BCE	Iron Age-Early Historic transition
88	Adichanallur	ASI	IUACD#23C5693	L-B/ZD17/IV/45 cm/Urn 13/Husk of Paddy	2840±54	890 BCE	1052 BCE	Iron Age-Early Historic transition
89	Vallam	Tamil University	PRL - 1109	-	2980±110	1030 BCE	1082 BCE	Iron Age-Early Historic transition
90	Vallam	Tamil University	PRL - 1111	-	2980±100	1030 BCE	1082 BCE	Iron Age-Early Historic transition
91	Vallam	Tamil University	PRL - 1110	-	2920±140	970 BCE	1125 BCE	Iron Age-Early Historic transition
92	Sivagalai	TNSDA	Beta - 600726	A2/Urn 3	2950±30	1000 BCE	1155 BCE	Iron Age-Early Historic transition
93	Adichanallur	ASI	IUACD#23C5692	L-C/ZM46/IV/233 cm/URN 38/Husk of Paddy	2947±46	997 BCE	1257 BCE	Iron Age-Early Historic transition
94	Thelunganur	Pondicherry University	AA - 99857	Sword from a grave	3089±40	1139 BCE	1334 BCE	Iron Age-Early Historic transition
95	Adichanallur	ASI	IUACD#23C5689	L-C/ZM45/I/218 cm/URN 7/Husk of Millet	3155±40	1205 BCE	1384 BCE	Iron Age-Early Historic transition
96	Mangadu	Pondicherry University	AA - 104114	Iron object from a grave	3213±34	1263 BCE	1510 BCE	Iron Age
97	Molapalayam	Tamil University	Beta - 605456	-	3250±30	1300 BCE	1545 BCE	Neolithic

Table 1: AMS dates for the Archaeological Sites of Tamil Nadu

S. No.	Site	Institution	Laboratory No.	Trench/ Layer/ Depth	Conventional Age in BP	Conventional Age	Calibrated Age	Clutural Period
98	Molapalayam	Tamil University	Beta - 605457	-	3290±30	1340 BCE	1562 BCE	Neolithic
99	Mayiladumparai	TNSDA	Beta - 620258	L-04/104 cm	3310 ±30	1360 BCE	1615 BCE	Iron Age
100	Kilnamandi	TNSDA	Beta - 666752	MEG-III	3400±30	1450 BCE	1692 BCE	Iron Age
101	Adichanallur	TNSDA	Beta - 583589	1/L-1/C7/3	3470±30	1520 BCE	1757 BCE	Iron Age
102	Chennanur	TNSDA	Beta - 759198	L-01/ZV2	3490±30	1540 BCE	1759 BCE	Neolithic
103	Chennanur	TNSDA	Beta - 759197	L-01/ZD4	3580±30	1630 BCE	1895 BCE	Neolithic
104	Chennanur	TNSDA	Beta - 759196	L-01/ZC3	3650±30	1700 BCE	2052 BCE	Neolithic
105	Mayiladumparai	TNSDA	Beta - 620259	L-04/2/130 cm	3760±30	1810 BCE	2172 BCE	Iron Age
106	Chennanur	TNSDA	Beta - 759199	L-01/C3	3790±30	1840 BCE	2199 BCE	Neolithic
107	Adichanallur	TNSDA	Beta - 583592	Habitation/4/220 cm	4010±30	2060 BCE	2522 BCE	Iron Age
108	Thelunganur	Pondicherry University	AA - 104832	Sword from a grave	4208±35	2250 BCE	2763 BCE	Iron Age
109	Sivagalai	TNSDA	Beta - 583594	C3/1	4300±30	2350 BCE	2953 BCE	Iron Age
110	Sivagalai	TNSDA	Beta - 583592	A2/Urn 1	4540±30	2590 BCE	3259 BCE	Iron Age
111	Sivagalai	TNSDA	Beta - 583593	Trench B3/Urn 10	4670±30	2720 BCE	3345 BCE	Iron Age
112	Chennanur	TNSDA	Oxford Luminescence Lab.	L-01/B3/193 cm	3.62±0.25 (3620)	10.47±0.85 (10470)	8450 BCE	Microlithic (Late Phase)

Table 2: OSL dates for the archaeological sites of Tamil Nadu								
S. No.	**Site**	**Institution**	**Trench/Layer /Depth**	**Material**	**Dose Rate**	**Age in BP**	**Calendar Year**	**Cultural Period**
1	Chennanur	Oxford	L-01/B3/193 cm	Sediment	3.62±0.25 (3620)	10.47±0.85 (10470)	-	Microlithic (Late Phase)
2	Sivagalai	BSIP	A2-Urn-1	Ceramic	-	4479	2459 BCE	Iron Age
3	Sivagalai	PRL	A2-Urn-1	Ceramic	-	4447	2427 BCE	Iron Age
4	Sivagalai	BSIP	A2-Urn-3	Ceramic	-	3304	1284 BCE	Iron Age
5	Sivagalai	BSIP	L13-Urn-5	Ceramic	-	3856	1836 BCE	Iron Age
6	Sivagalai	PRL	L13-Urn-5	Ceramic	-	4470	2450 BCE	Iron Age
7	Sivagalai	BSIP	L13-Urn-2	Ceramic	-	3929	1909 BCE	Iron Age
8	Sivagalai	BSIP	L13-Urn-8	Ceramic	-	4008	1988 BCE	Iron Age
9	Punalkulam	NGRI	82-83 cm	Sediment	2.7±0.4	9.8±1.4ka (9800)	7780 BCE	Mesolithic
10	Punalkulam	NGRI	236-239 cm	Sediment	2.6±0.4	42.4±6.3ka (42400)	40380 BCE	Palaeolithic to Mesolithic Transition
11	Punalkulam	NGRI	281-284 cm	Sediment	2.2±1.1	80.6 ±13.8ka (80600)	78580 BCE	Palaeolithic

Table 3: AMS dates for the Neolithic sites of Tamil Nadu

S. No	Site	Institution	Laboratory No.	Trench/ Layer/ Depth	Conventional Age in BP	Conventional Age in BCE	Calibrated Age	Cultural Period
1	Molapalayam	Tamil University	Beta - 605456	-	3250±30	1300 BCE	1545 BCE	Neolithic
2	Molapalayam	Tamil University	Beta - 605457	-	3290±30	1340 BCE	1562 BCE	Neolithic
3	Chennanur	TNSDA	Beta - 759198	L-01/ZV2	3490±30	1540 BCE	1759 BCE	Neolithic
4	Chennanur	TNSDA	Beta - 759197	L-01/ZD4	3580±30	1630 BCE	1895 BCE	Neolithic
5	Chennanur	TNSDA	Beta - 759196	L-01/ZC3	3650±30	1700 BCE	2052 BCE	Neolithic
6	Chennanur	TNSDA	Beta - 759199	L-01/C3	3790±30	1840 BCE	2199 BCE	Neolithic

Table 4: AMS and OSL dates for the Archaeological Site Chennanur								
S. No	**Site**	**Institution**	**Laboratory No**	**Trench/ Layer/ Depth**	**Conventional Age in BP**	**Conventional Age in BCE**	**Calibrated Age**	**Cultural Period**
1	Chennanur	TNSDA	Beta - 759198	L-01/ZV2	3490±30	1540 BCE	1759 BCE	Neolithic
2	Chennanur	TNSDA	Beta - 759197	L-01/ZD4	3580±30	1630 BCE	1895 BCE	Neolithic
3	Chennanur	TNSDA	Beta - 759196	L-01/ZC3	3650±30	1700 BCE	2052 BCE	Neolithic
4	Chennanur	TNSDA	Beta - 759199	L-01/C3	3790±30	1840 BCE	2199 BCE	Neolithic
5	Chennanur	TNSDA	Oxford	L - 01/B3/193 cm	Dose rate 3.62±0.25 (3620)	10.47±0.85 (10470)	8450 BCE	Microlithic (Late Phase)

Table 5: AMS and OSL dates for the Iron Age sites of Tamil Nadu

S. No	Site	Institution	Laboratory No	Method	Trench/ Layer/ Depth	Conventional Age in BP	Conventional Age in BCE	Calibrated Age	Cultural Period
1	Adichanallur	ASI	Beta - 519500	AMS	Urn No 105	2700±30	750 BCE	855 BCE	Iron Age-Early Historic Transition
2	Thelunganur	Pondicherry University	AA 104113	AMS	Arrowhead from a grave	2835±34	885 BCE	1009 BCE	Iron Age-Early Historic Transition
3	Vallam	Tamil University	PRL 1109	AMS	-	2980±110	1030 BCE	1082 BCE	Iron Age-Early Historic Transition
4	Vallam	Tamil University	PRL 1110	AMS	-	2920±140	970 BCE	1125 BCE	Iron Age-Early Historic Transition
5	Sivagalai	TNSDA	Beta 600726	AMS	A2/Urn 3	2950±30	1000 BCE	1155 BCE	Iron Age-Early Historic Transition
6	Adichanallur	ASI	IUACD #23C5692	AMS	L-C/ZM46/ IV/233 cm/Urn 38/Husk of Paddy	2947±46	997 BCE	1257 BCE	Iron Age-Early Historic Transition
7	Sivagalai	TNSDA	BSIP	OSL	A2/Urn 3	3304	-	1284 BCE	Iron Age
8	Thelunganur	Pondicherry University	AA 99857	AMS	Sword from a grave	3089±40	1139 BCE	1334 BCE	Iron Age
9	Adichanallur	ASI	IUACD #23C5689	AMS	L-C/ ZM45/I/218 cm/Urn 7/Husk of Millet	3155±40	1205 BCE	1384 BCE	Iron Age
10	Mangadu	Pondicherry University	AA 104114	AMS	Iron object from a grave	3213±34	1263 BCE	1510 BCE	Iron Age
11	Mayiladumparai	TNSDA	Beta - 620258	AMS	L-02/Trench 4-104 cm	3310±30	1360 BCE	1615 BCE	Iron Age
12	Kilnamandi	TNSDA	Beta - 666752	AMS	MEG III	3400±30	1450 BCE	1692 BCE	Iron Age
13	Adichanallur	TNSDA	Beta - 583589	AMS	1/L-1/C7/3	3470±30	1520 BCE	1757 BCE	Iron Age
14	Sivagalai	TNSDA	BSIP	OSL	L13/Urn 5	3856	-	1836 BCE	Iron Age
15	Sivagalai	TNSDA	BSIP	OSL	L13/Urn 2	3929	-	1909 BCE	Iron Age

Table 5: AMS and OSL dates for the Iron Age sites of Tamil Nadu									
S. No	**Site**	**Institution**	**Laboratory No**	**Method**	**Trench/ Layer/ Depth**	**Conventional Age in BP**	**Conventional Age in BCE**	**Calibrated Age**	**Cultural Period**
16	Sivagalai	TNSDA	BSIP	OSL	L13/Urn 8	4008	-	1988 BCE	Iron Age
17	Mayiladumparai	TNSDA	Beta - 620259	AMS	L-02/Trench 4/130 cm	3760±30	1810 BCE	2172 BCE	Iron Age
18	Sivagalai	TNSDA	PRL	OSL	A2/Urn 1	4447	-	2427 BCE	Iron Age
19	Sivagalai	TNSDA	PRL	OSL	L13/Urn 5	4470	-	2450 BCE	Iron Age
20	Sivagalai	TNSDA	BSIP	OSL	A2/Urn 1	4479	-	2459 BCE	Iron Age
21	Adichanallur	TNSDA	Beta - 583592	AMS	L-4/220 cm	4010±30	2060 BCE	2522 BCE	Iron Age
22	Thelunganur	Pondicherry University	AA 104832	AMS	Sword from a grave	4208±35	2250 BCE	2763 BCE	Iron Age
23	Sivagalai	TNSDA	Beta - 583594	AMS	C3/1	4300±30	2350 BCE	2953 BCE	Iron Age
24	Sivagalai	TNSDA	Beta - 583592	AMS	A2/Urn 1	4540±30	2590 BCE	3259 BCE	Iron Age
25	Sivagalai	TNSDA	Beta - 583593	AMS	B3/Urn 10	4670±30	2720 BCE	3345 BCE	Iron Age

Table 6: AMS dates for the Archaeological Site Adichanallur

S. No.	Site	Institution	Laboratory No.	Trench/ Layer/ Depth	Conventional Age in BP	Conventional Age in BCE	Calibrated Age	Cultural Period
1	Adichanallur	TNSDA	Beta - 583588	1/L-2/A1/4	2020±30	70 BCE	82 BCE	Early Historic
2	Adichanallur	ASI	IUACD# 23C5687	L-B/ZB18/IV/44 cm/Charcoal	2163±38	213 BCE	201 BCE	Early Historic
3	Adichanallur	TNSDA	Beta - 583590	1/L-2/ZB1/4	2170±30	220 BCE	243 BCE	Early Historic
4	Adichanallur	TNSDA	Beta - 583587	1/L-2/ZE/4	2190±30	240 BCE	267 BCE	Early Historic
5	Adichanallur	ASI	IUACD# 23C5686	L-B/ZD17/I/100 cm /Charcoal	2256±38	306 BCE	315 BCE	Early Historic
6	Adichanallur	ASI	IUACD#23C5696	L-C/ZM46/I/290 cm/Urn 46/Husk of Paddy	2279±47	329 BCE	319 BCE	Early Historic
7	Adichanallur	ASI	IUACD#23C5688	L-B/ZB18/IV/90 cm/Charcoal	2349±39	399 BCE	467 BCE	Early Historic
8	Adichanallur	ASI	IUACD#23C5698	L-A/XAS18/II/60 cm/Charred bone	2425±49	475 BCE	618 BCE	Early Historic
9	Adichanallur	ASI	Beta - 519499	Urn No.58	2510±30	610 BCE	645 BCE	Early Historic
10	Adichanallur	ASI	IUACD#23C5690	L-B/ZB18/I/155 cm/Urn 4/Husk of Paddy	2512±33	562 BCE	665 BCE	Early Historic
11	Adichanallur	ASI	IUACD#23C5695	L-C/ZM45/IV/155 cm/Urn 3/Husk of Paddy	2522±36	572 BCE	668 BCE	Early Historic
12	Adichanallur	ASI	Beta - 519499	Urn No.58	2510±30	560 BCE	682 BCE	Early Historic
13	Adichanallur	ASI	IUACD#23C5691	L-C/ZM45/I/212 cm/Urn 7/Husk of Paddy	2593±34	643 BCE	691 BCE	Early Historic
14	Adichanallur	ASI	Beta - 519500	Urn No.105	2700±31	750 BCE	850 BCE	Early Historic
15	Adichanallur	ASI	Beta - 519500	Urn No.105	2700±30	750 BCE	855 BCE	Iron Age

Table 6: AMS dates for the Archaeological Site Adichanallur								
S. No.	Site	Institution	Laboratory No.	Trench/ Layer/ Depth	Conventional Age in BP	Conventional Age in BCE	Calibrated Age	Cultural Period
16	Adichanallur	ASI	IUACD#23C5694	L-C/ZN45/III/318 cm/Urn 17/Husk of Paddy	2759±33	809 BCE	908 BCE	Iron Age-Early Historic transition
17	Adichanallur	ASI	IUACD#23C5693	L-B/ZD17/IV/45 cm/Urn 13/Husk of Paddy	2840±54	890 BCE	1052 BCE	Iron Age-Early Historic transition
18	Adichanallur	ASI	IUACD#23C5692	L-C/ZM46/IV/233 cm/Urn 38/Husk of Paddy	2947±46	997 BCE	1257 BCE	Iron Age
19	Adichanallur	ASI	IUACD#23C5689	L-C/ZM45/I/218 cm/Urn 7/Husk of Millet	3155±40	1205 BCE	1384 BCE	Iron Age
20	Adichanallur	TNSDA	Beta - 583589	1/L-1/C7/3	3470±30	1520 BCE	1757 BCE	Iron Age
21	Adichanallur	TNSDA	Beta - 583592	Habitation/4/220 cm	4010±30	2060 BCE	2522 BCE	Iron Age

Table 7: AMS and OSL dates for the Archaeological Site Sivagalai

S. No	Site	Institution	Laboratory No	Method	Trench/ Layer/ Depth	Conventional Age in BP	Conventional Age in BCE	Calibrated Age	Cultural Period
1	Sivagalai	TNSDA	Beta - 600727	AMS	Habitation	2560±30	610 BCE	685 BCE	Early Historic
2	Sivagalai	TNSDA	Beta - 600726	AMS	A2/Urn 3	2950±30	1000 BCE	1155 BCE	Iron Age-Early Historic Transition
3	Sivagalai	TNSDA	BSIP	OSL	A2/Urn - 3	3304	-	1284 BCE	Iron Age
4	Sivagalai	TNSDA	BSIP	OSL	L13/Urn - 5	3856	-	1836 BCE	Iron Age
5	Sivagalai	TNSDA	BSIP	OSL	L13/Urn - 2	3929	-	1909 BCE	Iron Age
6	Sivagalai	TNSDA	BSIP	OSL	L13/Urn - 8	4008	-	1988 BCE	Iron Age
7	Sivagalai	TNSDA	BSIP	OSL	A2/Urn - 1	4447	-	2427 BCE	Iron Age
8	Sivagalai	TNSDA	BSIP	OSL	A2/Urn - 1	4479	-	2459 BCE	Iron Age
9	Sivagalai	TNSDA	Beta - 583594	AMS	C3/1	4300 ±30	2350 BCE	2953 BCE	Iron Age
10	Sivagalai	TNSDA	PRL	OSL	L13/Urn - 5	4470	-	2450 BCE	Iron Age
11	Sivagalai	TNSDA	Beta - 583592	AMS	A2/Urn 1	4540 ±30	2590 BCE	3259 BCE	Iron Age
12	Sivagalai	TNSDA	Beta - 583593	AMS	B3/Urn 10	4670+-30	2720 BCE	3345 BCE	Iron Age

Table 8: AMS dates for the Early Historic Sites yielding Tamil̲i (Tamil-Brahmi) inscribed potsherds of Tamil Nadu								
S. No	**Site**	**Institution**	**Laboratory No**	**Trench/ Layer/ Depth**	**Conventional Age in BP**	**Conventional Age**	**Calibrated Age**	**Clutural Period**
1	Keeladi	TNSDA	Beta - 620260	YP4/136 cm	1750±30	200 CE	357 CE	Early Historic
2	Keeladi	TNSDA	Beta - 583573	YD3/1/575 cm	1850 ± 30	100 CE	243 CE	Early Historic
3	Keeladi	TNSDA	Beta - 583571	YD3/1/400 cm	1810 ± 30	140 CE	221 CE	Early Historic
4	Keeladi	TNSDA	Beta - 583572	YD3/1/520 cm	1820 ± 30	130 CE	220 CE	Early Historic
5	Kilnamandi	TNSDA	Beta - 759200	Z84	1900 ± 30	50 CE	144 CE	Early Historic
6	Porpanaikottai	TNSDA	Beta - 759189	B1	1880 ± 30	70 CE	141 CE	Early Historic
7	Adichanallur	TNSDA	Beta - 583588	1/L-2/A1/4	2020 ± 30	70 BCE	82 BCE	Early Historic
8	Marungur	TNSDA	Beta - 759206	ZB1	1990 ± 30	40 BCE	84 BCE	Early Historic
9	Keeladi	TNSDA	Beta - 620261	YP4/168 cm	2000 ± 30	50 BCE	86 BCE	Early Historic
10	Marungur	TNSDA	Beta - 759205	A1	1950 ± 30	0 BCE	87 BCE	Early Historic
11	Kodumanal	TNSDA	Beta - 583599	XC16/4	2090 ± 30	140 BCE	99 BCE	Early Historic
12	Kodumanal	TNSDA	Beta - 583598	XC16/4	2030 ± 30	80 BCE	115 BCE	Early Historic
13	Keeladi	ASI	Beta - 521460	YFl/1/145	2090 ± 30	140 BCE	128 BCE	Early Historic
14	Keeladi	TNSDA	Beta - 519481	A3/4/347 cm	2140 ± 30	190 BCE	145 BCE	Early Historic
15	Alagankulam	TNSDA	Beta - 494630	ZC3/4/90 cm	2030 ± 30	80 BCE	188 BCE	Early Historic
16	Thulukkarpatti	TNSDA	Beta - 759194	YD21	2170 ± 30	220 BCE	188 BCE	Early Historic
17	Kilnamandi	TNSDA	Beta - 759201	Z84	2180 ± 30	230 BCE	189 BCE	Early Historic

Table 8: AMS dates for the Early Historic Sites yielding Tamiḻi (Tamil-Brahmi) inscribed potsherds of Tamil Nadu

S. No	Site	Institution	Laboratory No	Trench/ Layer/ Depth	Conventional Age in BP	Conventional Age	Calibrated Age	Clutural Period
18	Thulukkarpatti	TNSDA	Beta - 759195	YF23	2180 ± 30	230 BCE	189 BCE	Early Historic
19	Alagankulam	TNSDA	Beta - 494633	YD7/4/138 cm	2170 ± 30	220 BCE	191 BCE	Early Historic
20	Korkai	TNSDA	Beta - 640450	V17/3/190 cm	2180 ± 30	230 BCE	191 BCE	Early Historic
21	Keeladi	ASI	Beta - 489244	YG4/NW	2170 ± 30	220 BCE	192 BCE	Early Historic
22	Kodumanal	Pondicherry University	Beta - 351053	ZD20/15 cm	2150 ± 30	200 BCE	200 BCE	Early Historic
23	Kodumanal	Pondicherry University	-	P2/4/82 cm	2180 ± 30	210 BCE	200 BCE	Early Historic
24	Adichanallur	ASI	IUACD #23C5687	L-B/ZB18/IV/44 cm/Charcoal	2163 ± 38	213 BCE	201 BCE	Early Historic
25	Keeladi	TNSDA	Beta - 519478	A3/2/195 cm	1770 ± 30	180 BCE	221 BCE	Early Historic
26	Keeladi	TNSDA	Beta - 640442	XM9/3/145 cm	2120 ± 30	170 BCE	223 BCE	Early Historic
27	Kilnamandi	TNSDA	Beta - 759202	XBS4	2110 ± 30	160 BCE	226 BCE	Early Historic
28	Thulukkarpatti	TNSDA	Beta - 759193	YF24	2110±30	160 BCE	226 BCE	Early Historic
29	Alagankulam	TNSDA	Beta - 494631	ZC3/4/348 cm	2130 ± 30	180 BCE	230 BCE	Early Historic
30	Keeladi	TNSDA	Beta - 759211	YC3/2	2210 ± 30	260 BCE	237 BCE	Early Historic
31	Thulukkarpatti	TNSDA	Beta - 759192	YF23	2160 ± 30	210 BCE	239 BCE	Early Historic
32	Keeladi	TNSDA	Beta - 640441	XM11/2/140 cm	2160 ± 30	210 BCE	241 BCE	Early Historic
33	Korkai	TNSDA	Beta - 640451	P2/4/82 cm	2160 ± 30	210 BCE	241 BCE	Early Historic

Table 8: AMS dates for the Early Historic Sites yielding Tamiḻi (Tamil-Brahmi) inscribed potsherds of Tamil Nadu								
S. No	**Site**	**Institution**	**Laboratory No**	**Trench/ Layer/ Depth**	**Conventional Age in BP**	**Conventional Age**	**Calibrated Age**	**Clutural Period**
34	Mayiladumparai	TNSDA	Beta - 620257	L-06/K10/76 cm	1810 ± 30	140 CE	241 BCE	Early Historic
35	Adichanallur	TNSDA	Beta - 583590	1/L-2/ZB1/4	2170 ± 30	220 BCE	243 BCE	Early Historic
36	Mayiladumparai	TNSDA	Beta - 620256	L-06/K10/105 cm	1850 ± 30	100 CE	243 BCE	Early Historic
37	Keeladi	TNSDA	Beta - 519480	A2/1/371 cm	2180 ± 30	230 BCE	264 BCE	Early Historic
38	Porpanaikottai	TNSDA	Beta- 759190	H2	2230 ± 30	280 BCE	265 BCE	Early Historic
39	Adichanallur	TNSDA	Beta - 583587	1/L-2/ZE/4	2190 ± 30	240 BCE	267 BCE	Early Historic
40	Keeladi	TNSDA	Beta - 640443	XM10/2/168 cm	2190 ± 30	240 BCE	267 BCE	Early Historic
41	Keeladi	TNSDA	Beta - 583577	YE6/4/229 cm	2200 ± 30	250 BCE	268 BCE	Early Historic
42	Keeladi	TNSDA	Beta - 759208	YW11/3	2220 ± 30	270 BCE	268 BCE	Early Historic
43	Keeladi	TNSDA	Beta - 519479	A3/2/207 cm	2190 ± 30	240 BCE	269 BCE	Early Historic
44	Keeladi	ASI	Beta - 521462	YBl/3/298 cm	2190 ± 30	240 BCE	269 BCE	Early Historic
45	Keeladi	TNSDA	Beta - 640444	XM13/2/226 cm	2200 ± 30	250 BCE	271 BCE	Early Historic
46	Keeladi	ASI	Beta - 521459	YFl/2/85	2200 ± 30	250 BCE	276 BCE	Early Historic
47	Keeladi	TNSDA	Beta - 759207	YU11/3	2270 ± 30	320 BCE	281 BCE	Early Historic
48	Keeladi	ASI	Beta - 521458	YEl/2/93 cm	2210 ± 30	260 BCE	285 BCE	Early Historic
49	Keeladi	ASI	Beta 521461	ZA l/3/273 cm	2160 ± 30	210 BCE	301 BCE	Early Historic
50	Keeladi	TNSDA	Beta - 620262	YQ5/299 cm	2230 ± 30	280 BCE	312 BCE	Early Historic

Table 8: AMS dates for the Early Historic Sites yielding Tamiḻi (Tamil-Brahmi) inscribed potsherds of Tamil Nadu

S. No	Site	Institution	Laboratory No	Trench/ Layer/ Depth	Conventional Age in BP	Conventional Age	Calibrated Age	Clutural Period
51	Thulukkarpatti	TNSDA	Beta - 759191	ZQ11	2240 ± 30	290 BCE	312 BCE	Early Historic
52	Keeladi	TNSDA	Beta - 519477	A2/4/ 315 cm	2230 ± 30	280 BCE	313 BCE	Early Historic
53	Adichanallur	ASI	IUACD# 23C5686	L-B/ZD17/I/100 cm /Charcoal	2256 ± 38	306 BCE	315 BCE	Early Historic
54	Keeladi	TNSDA	Beta - 583574	YD3/1/333 cm	2270 ± 30	320 BCE	315 BCE	Early Historic
55	Keeladi	ASI	Beta - 489243	YG6/SW	2260 ± 30	310 BCE	316 BCE	Early Historic
56	Adichanallur	ASI	IUACD#23C5696	L-C/ZM46/I/290 cm/Urn 46/Husk of Paddy	2279 ± 47	329 BCE	319 BCE	Early Historic
57	Keeladi	ASI	Beta - 454597	YF4/2/195 cm	2200 ± 30	250 BCE	320 BCE	Early Historic
58	Alagankulam	TNSDA	Beta - 494632	ZC3/4/611 cm	2320 ± 30	370 BCE	326 BCE	Early Historic
59	Keeladi	ASI	Beta - 454596	YFl/1/250 cm	2170 ± 30	220 BCE	332 BCE	Early Historic
60	Kodumanal	Pondicherry University	Beta - 349958	ZD20/65 cm	2250 ± 30	300 BCE	370 BCE	Early Historic
61	Keeladi	TNSDA	Beta - 759209	YW11/2 cm	2490 ± 30	540 BCE	377 BCE	Early Historic
62	Kodumanal	Pondicherry University	Beta - 330303	ZD10/80 cm	2280 ± 30	330 BCE	380 BCE	Early Historic
63	Kodumanal	Pondicherry University	AA - 99856	ZE10/60 cm	2225 ± 41	275 BCE	380 BCE	Early Historic
64	Adichanallur	ASI	IUACD#23C5688	L-B/ZB18/IV/90 cm/Charcoal	2349 ± 39	399 BCE	467 BCE	Early Historic
65	Keeladi	TNSDA	Beta - 583575	YD4/2/356 cm	2380 ± 30	430 BCE	467 BCE	Early Historic
66	Kodumanal	Pondicherry University	AA - 99855	ZE9/120 cm	2358 ± 40	408 BCE	480 BCE	Early Historic

Table 8: AMS dates for the Early Historic Sites yielding Tamiḻi (Tamil-Brahmi) inscribed potsherds of Tamil Nadu								
S. No	Site	Institution	Laboratory No	Trench/ Layer/ Depth	Conventional Age in BP	Conventional Age	Calibrated Age	Clutural Period
67	Perumbalai	TNSDA	Beta - 640429	L-01/292 cm	2360 ± 30	410 BCE	493 BCE	Early Historic
68	Keeladi	TNSDA	Beta - 583578	YE6/4/300 cm	2400 ± 30	450 BCE	516 BCE	Early Historic
69	Keeladi	TNSDA	Beta - 519476	YP7/4/353 cm	2530 ± 30	580 BCE	531 BCE	Early Historic
70	Keeladi	TNSDA	Beta - 583576	YD4/2/384 cm	2470 ± 30	520 BCE	540 BCE	Early Historic
71	Porunthal	Pondicherry University	Beta - 305904	Meg-4	2400 ± 35	450 BCE	560 BCE	Early Historic
72	Keeladi	TNSDA	Beta - 583579	YS8/4/350	2490 ± 30	540 BCE	563 BCE	Early Historic
73	Perumbalai	TNSDA	Beta - 640431	L-01/C1/228 cm	2450 ± 30	500 BCE	570 BCE	Early Historic
74	Porunthal	Pondicherry University	Beta - 302854	Meg-1	2440 ± 36	490 BCE	580 BCE	Early Historic
75	Adichanallur	ASI	IUACD#23C5698	L-A/XAS18/II/60 cm/Charred bone	2425 ± 49	475 BCE	618 BCE	Early Historic
76	Perumbalai	TNSDA	Beta - 640430	L-01/IE3/263 cm	2440 ± 30	490 BCE	630 BCE	Early Historic
77	Adichanallur	ASI	Beta - 519499	Urn No.58	2510 ± 30	610 BCE	645 BCE	Early Historic
78	Adichanallur	ASI	IUACD#23C5690	L-B/ZB18/I/155 cm/Urn 4/Husk of Paddy	2512 ± 33	562 BCE	665 BCE	Early Historic
79	Adichanallur	ASI	IUACD#23C5695	L-C/ZM45/IV/155 cm/Urn 3/Husk of Paddy	2522 ± 36	572 BCE	668 BCE	Early Historic
80	Perumbalai	TNSDA	Beta - 640432	B3(L-01)	2540 ± 30	590 BCE	682 BCE	Early Historic
81	Sivagalai	TNSDA	Beta - 600727	Habitation	2560 ± 30	610 BCE	685 BCE	Early Historic
82	Adichanallur	ASI	IUACD#23C5691	L-C/ZM45/I/212 cm/Husk of Paddy	2593 ± 34	643 BCE	691 BCE	Early Historic

Table 9: AMS dates for the Archaeological Site Keeladi								
S. No	**Site**	**Institution**	**Laboratory No.**	**Trench/ Layer/ Depth**	**Conventional Age in BP**	**Conventional Age**	**Calibrated Age**	**Cultural Period**
1	Keeladi	TNSDA	Beta - 620260	YP4/136 cm	1750 ±30	1750±30	357 CE	Early Historic
2	Keeladi	TNSDA	Beta - 583573	YD3/1/575 cm	1850 ±30	1850±30	243 CE	Early Historic
3	Keeladi	TNSDA	Beta - 583571	YD3/1/400 cm	1810 ±30	1810±30	221 CE	Early Historic
4	Keeladi	TNSDA	Beta - 583572	YD3/1/520 cm	1820 ±30	1820±30	220 CE	Early Historic
5	Keeladi	TNSDA	Beta - 620261	YP4/168 cm	2000 ±30	2000±30	86 BCE	Early Historic
6	Keeladi	ASI	Beta - 521460	YFl/1/145 cm	2090 ±30	2090±30	128 BCE	Early Historic
7	Keeladi	TNSDA	Beta - 519481	A3/4/347 cm	2140 ±30	2140±30	145 BCE	Early Historic
8	Keeladi	ASI	Beta - 489244	YG4/NW	2170 ±30	2170±30	192 BCE	Early Historic
9	Keeladi	TNSDA	Beta - 519478	A3/2/195 cm	1770 ±30	1770±30	221 BCE	Early Historic
10	Keeladi	TNSDA	Beta - 640442	XM9/3/145 cm	2120 ±30	2120±30	223 BCE	Early Historic
11	Keeladi	TNSDA	Beta - 759211	YC3/2	2210 ±30	2210±30	237 BCE	Early Historic
12	Keeladi	TNSDA	Beta - 640441	XM11/2/140 cm	2160 ±30	2160±30	241 BCE	Early Historic
13	Keeladi	TNSDA	Beta - 519480	A2/1/371 cm	2180 ±30	2180±30	264 BCE	Early Historic
14	Keeladi	TNSDA	Beta - 640443	XM10/2/168 cm	2190 ±30	2190±30	267 BCE	Early Historic
15	Keeladi	TNSDA	Beta - 583577	YE6/4/229 cm	2200 ±30	2200±30	268 BCE	Early Historic
16	Keeladi	TNSDA	Beta - 759208	YW11/3	2220 ±30	2220±30	268 BCE	Early Historic
17	Keeladi	TNSDA	Beta - 519479	A3/2/207 cm	2190 ±30	2190±30	269 BCE	Early Historic
18	Keeladi	ASI	Beta - 521462	YB1/3/298 cm	2190 ±30	2190±30	269 BCE	Early Historic
19	Keeladi	TNSDA	Beta - 640444	XM13/2/226 cm	2200 ±30	2200±30	271 BCE	Early Historic

Table 9: AMS dates for the Archaeological Site Keeladi								
S. No	**Site**	**Institution**	**Laboratory No.**	**Trench/ Layer/ Depth**	**Conventional Age in BP**	**Conventional Age**	**Calibrated Age**	**Cultural Period**
20	Keeladi	ASI	Beta - 521459	YFl/2/85	2200 ±30	2200±30	276 BCE	Early Historic
21	Keeladi	TNSDA	Beta - 759207	YU11/3	2270 ±30	2270±30	281 BCE	Early Historic
22	Keeladi	ASI	Beta - 521458	YEl/2/93 cm	2210 ±30	2210±30	285 BCE	Early Historic
23	Keeladi	ASI	Beta - 521461	ZA1/3/273 cm	2160 ±30	2160±30	301 BCE	Early Historic
24	Keeladi	TNSDA	Beta - 620262	YQ5/299 cm	2230 ±30	2230±30	312 BCE	Early Historic
25	Keeladi	TNSDA	Beta - 519477	A2/4/315 cm	2230 ±30	2230±30	313 BCE	Early Historic
26	Keeladi	TNSDA	Beta - 583574	YD3/1/333 cm	2270 ±30	2270±30	315 BCE	Early Historic
27	Keeladi	ASI	Beta - 489243	YG6/SW	2260 ±30	2260±30	316 BCE	Early Historic
28	Keeladi	ASI	Beta - 454597	YF4/2/195 cm	2200 ±30	2200±30	320 BCE	Early Historic
29	Keeladi	ASI	Beta - 454596	YFl/1/250	2170 ±30	2170±30	332 BCE	Early Historic
30	Keeladi	TNSDA	Beta - 759209	YW11/2	2490 ±30	2490±30	377 BCE	Early Historic
31	Keeladi	TNSDA	Beta - 583575	YD4/2/356 cm	2380 ±30	2380±30	467 BCE	Early Historic
32	Keeladi	TNSDA	Beta - 583578	YE6/4/300 cm	2400 ±30	2400±30	516 BCE	Early Historic
33	Keeladi	TNSDA	Beta - 519476	YP7/4/353 cm	2530 ±30	2530±30	531 BCE	Early Historic
34	Keeladi	TNSDA	Beta - 583576	YD4/2/384 cm	2470 ±30	2470±30	540 BCE	Early Historic
35	Keeladi	TNSDA	Beta - 583579	YS8/4/350	2490 ±30	2490±30	563 BCE	Early Historic

Table 10: AMS dates for the Archaeological Site Kodumanal

S. No.	Site	Institution	Submitter No.	Laboratory No.	Trench/ Layer/ Depth	Conventional Age in BP	Conventional Age in BCE	Calibrated Age	Calibrated Age Range	Cultural Period
1	Kodumanal	TNSDA	KML2020-004	Beta - 583599	-	2090 ±30	140 BCE	99 BCE	190 BCE-8 BCE	Early Historic
2	Kodumanal	TNSDA	KML2020-003	Beta - 583598	-	2030 ±30	80 BCE	115 BCE	143 BCE-87 BCE	Early Historic
3	Kodumanal	Pondicherry University	KDL-sample 1	Beta - 351053	KDL-ZD20/15cm	2150 ±30	200 BCE	200 BCE	200 BCE	Early Historic
4	Kodumanal	Pondicherry University	KDL-sample 1	-	P2/4/82 cm	2180 ±30	210 BCE	200 BCE	356 BCE-279 BCE	Early Historic
5	Kodumanal	Pondicherry University	KDL-sample 1	Beta - 349958	KDL-ZD20/65 cm	2250 ±30	300 BCE	370 BCE	370 BCE	Early Historic
6	Kodumanal	Pondicherry University	KDL-sample 1	Beta - 330303	KDL-ZD-lO/80 cm	2280 ±30	330 BCE	380 BCE	380 BCE	Early Historic
7	Kodumanal	Pondicherry University	KDL-sample 1	AA 99856	KDL-ZElO/60 cm	2225 ±41	275 BCE	380 BCE	380 BCE	Early Historic
8	Kodumanal	Pondicherry University	KDL-sample 1	AA 99855 (University of Arizona)	KDL-ZE9/120 cm	2358 ±40	408 BCE	480 BCE	480 BCE	Early Historic

Table 11: AMS dates for the Archaeological Sites Vembakottai and Pattaraiperumpudur								
S. No	**Site**	**Institution**	**Laboratory No.**	**Trench/ Layer/ Depth**	**Conventional Age in BP**	**Conventional Age in BCE**	**Calibrated Age**	**Cultural Period**
1	Pattaraiperumpudur	TNSDA	Beta-709376	-	2370±30	420 BCE	**464 BCE**	Early Historic
2	Pattaraiperumpudur	TNSDA	Beta-543226	-	2130±30	180 BCE	**128 BCE**	Early Historic
3	Pattaraiperumpudur	TNSDA	Beta-543223	-	2080±30	130 BCE	**100 BCE**	Early Historic
4	Pattaraiperumpudur	TNSDA	Beta-543224	-	1950±30	0 BCE/CE	**68 CE**	Early Historic
5	Pattaraiperumpudur	TNSDA	Beta-543225	-	1870±30	80 CE	**90 CE**	Early Historic
6	Pattaraiperumpudur	TNSDA	Beta-543222	-	1940±30	10 CE	**107 CE**	Early Historic
7	Pattaraiperumpudur	TNSDA	Beta-709377	-	1930±30	20 CE	**114 CE**	Early Historic
8	Pattaraiperumpudur	TNSDA	Beta-543221	-	1920±30	30 CE	**118 CE**	Early Historic
9	Vembakottai	TNSDA	Beta-734367	DDD8/2/166 cm	1830±30	120 CE	**247 CE**	Historic
10	Vembakottai	TNSDA	Beta-672993	A2/2/130 cm	1690±30	260 CE	**321 CE**	Historic
11	Vembakottai	TNSDA	Beta-734365	ZJ3/2/235 cm	1740±30	210 CE	**324 CE**	Historic
12	Vembakottai	TNSDA	Beta-672994	D1/2/240 cm	1680±30	270 CE	**390 CE**	Historic
13	Vembakottai	TNSDA	Beta-734363	V3/3/249 cm	1630±30	320 CE	**461 CE**	Historic
14	Vembakottai	TNSDA	Beta-734364	ZJ4/2/250 cm	1570±30	380 CE	**495 CE**	Historic
15	Vembakottai	TNSDA	Beta-734366	EEE8/2/175 cm	1500±30	450 CE	**538 CE**	Historic

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Appendix

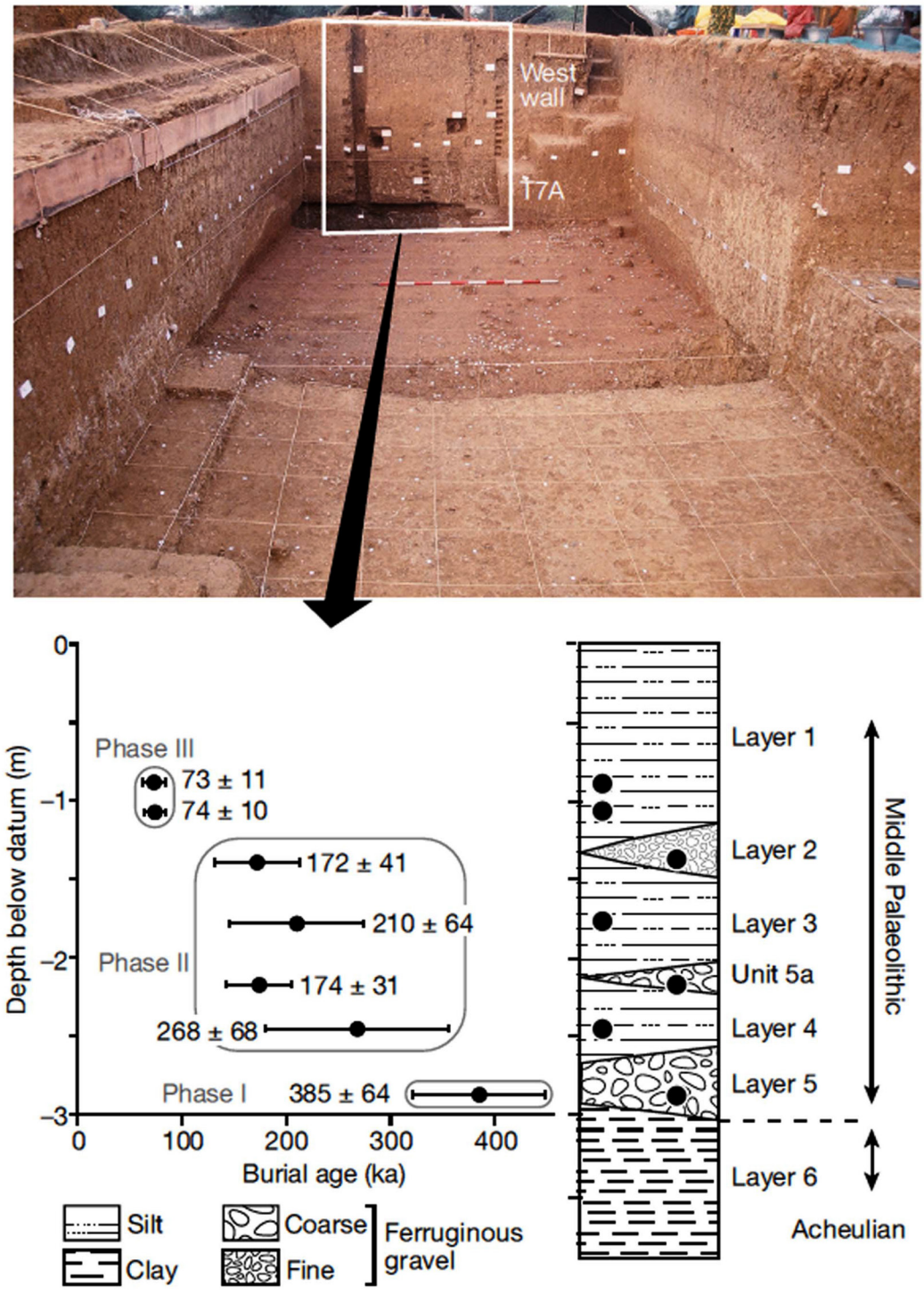
Cosmogenic nuclide concentrations and Aceulian artifact burial ages

Samples	Depth* (cm)	^{10}Be† (10^6 at·g^{-1})	^{26}Al† (10^6 at·g^{-1})	Minimum burial age‡ (Ma)	Denudation before burial§ (m·My^{-1})	Maximum burial age‡ (Ma)	Denudation before and after burial (m·My^{-1})
T8 6074	755	0.508 ± 0.03	1.131 ± 0.254	1.89 ± 0.44	1.44 ± 0.34	2.16 ± 0.5	1.39 ± 0.32
T8 8824	950	0.543 ± 0.017	1.29 ± 0.123	1.75 ± 0.18	1.45 ± 0.15	1.93 ± 0.19	1.43 ± 0.15
T7A 6877	487	0.436 ± 0.02	1.032 ± 0.103	1.81 ± 0.2	1.87 ± 0.21	2.22 ± 0.24	1.78 ± 0.2
T3 B1-14	532	0.514 ± 0.041	1.493 ± 0.072	1.38 ± 0.13	1.99 ± 0.19	1.57 ± 0.15	2.03 ± 0.2
T3 B1-197	642	0.76 ± 0.062	2.082 ± 0.098	1.39 ± 0.13	1.17 ± 0.11	1.52 ± 0.14	1.17 ± 0.11
T3 B1-337	855	0.429 ± 0.034	1.236 ± 0.051	1.43 ± 0.13	2.44 ± 0.23	1.59 ± 0.14	2.47 ± 0.23

*All depths obtained from individual trench datums were standardized by reference to a common stratigraphic datum coinciding with the highest point at the site. Density of materials is 2.2 g·cm^{-3}. †Measurement uncertainties are restricted here to analytical uncertainties within 1 SD. ‡Minimum and maximum ages are calculated following (*11*). The minimum burial age calculations are based on the stratigraphic and geomorphic evidence that the samples were deeply buried in the past but were recently brought nearer the surface by erosion of the topsoil. Maximum burial ages account for postburial production of ^{10}Be and ^{26}Al by muons. In the latter case, denudation is considered constant before and after burial. Burial-age uncertainties (±1σ) include systematic errors in half-lives. Spallation productions are 2.88 and 19.03 at·g^{-1}·year^{-1} for ^{10}Be and ^{26}Al, respectively. Likewise, slow and fast muon contributions are 0.07 (^{10}Be) and 0.46 (^{26}Al) at·g^{-1}·year^{-1} and 0.03 (^{10}Be) and 0.20 (^{26}Al) at·g^{-1}·year^{-1}, respectively. §Calculated background denudation rates are maximum rates. The low values obtained are consistent with the low-elevation, low-relief topographic setting close to oceanic base level. Further, the fact that ^{10}Be concentrations among artifacts are statistically similar (see SOM text) suggests that the clasts share similar preburial exposure histories, implying that hominins exploited surface scatters of raw material clasts.

Attirampakkam : Scientific dates for the Lower Palaeolithic tools

(Shanti Pappu 2011 *Science* vol.331:1597 25th March 2011)



Attirampakkam

Post-Infrared infrared-stimulated luminescence (pIR-IRSL) dates for Middle Palaeolithic tools

(Kumar Akhilesh 2018. *Nature* vol.554:99 1st February 2018)

Punalkulam : Optically Stimulated Luminescence Dating (OSL)

Sample Code	U (ppm)	Th (ppm)	K (%)	Dose rate (Gy/ka)	Palaeodose (Gy)	Age (ka)
PKM-3 (82-83 cm)	3.5 ± 1.1	22.4 ± 3.6	0.43 ± 0.18	2.7 ± 0.4	26.8 ± 0.6	9.8 ± 1.4
PKM-2 (236-239 cm)	1.5 ± 1.1	27.9 ± 3.8	0.41 ± 0.18	2.6 ± 0.4	110.0 ± 3.7	42.4 ± 6.3
PKM-1 (281-284 cm)	2.0 ± 1.1	22.4 ± 3.7	0.24 ± 0.18	2.2 ± 1.1	179.5 ± 2.3	80.6 ± 13.8

(courtesy: V.Selvakumar, Tamil University, Thanjavur; P.Mortekai and D.Reddy, National Geophysical Research Institute)

SCHOOL OF GEOGRAPHY AND THE ENVIRONMENT
UNIVERSITY OF OXFORD CENTRE FOR THE ENVIRONMENT

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23rd June 2025

Professor K Rajan

Tamil Nadu State Department of Archaeology
Government of Tamil Nadu
Tamilsalai
Chennai 600008
India

Dear Professor K Rajan,

Thank you for submitting your sample for optically stimulated luminescence (OSL) dating at the Oxford Luminescence Dating Laboratory, University of Oxford.

Your sample has been dating using the OSL signal from quartz using the single aliquot regenerative protocol and I can confirm the calculated age is 10.47 ± 0.85 ka.

Sample	Equivalent Dose (Gy)	Dose Rate (Gy/ka)	Age (ka)
CNR24-SS01	37.91 ± 1.62	3.62 ± 0.25	10.47 ± 0.85

Please see the following full dating report for further details relating to your sample.

Yours faithfully,

J Durcan

Dr Julie Durcan

Researcher, School of Geography and the Environment, University of Oxford
Oxford Luminescence Dating Laboratory Co-ordinator

ISO/IEC 17025:2017-Accredited Testing Laboratory

Beta Analytic, LLC
4985 SW 74th Court
Miami, FL 33155 USA
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REPORT OF RADIOCARBON DATING ANALYSIS

Submitter **Sivanantham Ramalingam**
Company **Department of Archaeology**
Laboratory Number **Beta-759196**
Sample Code CNR/L – 01 ZC3/2024 -1

Received Date **July 3, 2025**
Report Date **July 24, 2025**

To validate report, scan this QR code on a mobile device or go to https://verify.betalabservices.com and enter the requested information.

Conventional Radiocarbon Age **3650 +/- 30 BP**
Ratio of Stable Isotopes **IRMS δ13C: -23.51 ± 0.30 o/oo**

95.4% Probability Calibrated Range(s)

(69.3%)	**2070 - 1935 cal BC**	**(4020 - 3885 cal BP)**
(26.1%)	**2135 - 2075 cal BC**	**(4085 - 4025 cal BP)**

Submitter Material	Charcoal
Pretreatment	(Charred material):acid/alkali/acid
Analyzed Material	Charred material
Analysis Service	AMS-Standard Delivery
Percent Modern Carbon	63.48 +/- 0.24 pMC
Fraction Modern Carbon	0.6348 +/- 0.0024
D14C	-365.16 +/- 2.37 o/oo
Δ14C	-370.89 +/- 2.37 o/oo (1950:2025)
Measured Radiocarbon Age	(without d13C correction): 3630 +/- 30 BP
Calibration	BetaCal 5.0: High Probability Density Range Method: INTCAL20

Results are ISO/IEC-17025 accredited. All work was done at Beta in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" was calculated using the Libby half -life (5568 years), is corrected for total isotopic fraction and was used for calendar calibration where applicable.The Age is rounded to the nearest 10years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted errors are 1sigma counting statistics. Calculated sigmas less than 30BP on the Conventional Radiocarbon Age are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C). d13C and d15N values are relative to VPDB. References for calendar calibrations are cited at the bottom of calibration graph pages.

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REPORT OF RADIOCARBON DATING ANALYSIS

Submitter **Sivanantham Ramalingam**
Company **Department of Archaeology**
Laboratory Number **Beta-759199**
Sample Code CNR/ L – 01 C 3/2024 -4

Received Date **July 3, 2025**
Report Date **July 24, 2025**

To validate report, scan this QR code on a mobile device or go to https://verify.betalabservices.com and enter the requested information.

Conventional Radiocarbon Age **3790 +/- 30 BP**
Ratio of Stable Isotopes **IRMS δ13C: -23.92 ± 0.30 o/oo**

95.4% Probability Calibrated Range(s)

(91.9%)	**2304 - 2134 cal BC**	**(4254 - 4084 cal BP)**
(2.2%)	**2339 - 2319 cal BC**	**(4289 - 4269 cal BP)**
(1.3%)	**2078 - 2062 cal BC**	**(4028 - 4012 cal BP)**

Submitter Material	Charcoal
Pretreatment	(Charred material):acid/alkali/acid
Analyzed Material	Charred material
Analysis Service	AMS-Standard Delivery
Percent Modern Carbon	62.39 +/- 0.23 pMC
Fraction Modern Carbon	0.6239 +/- 0.0023
D14C	-376.13 +/- 2.33 o/oo
Δ14C	-381.76 +/- 2.33 o/oo (1950:2025)
Measured Radiocarbon Age	(without d13C correction): 3770 +/- 30 BP
Calibration	BetaCal 5.0: High Probability Density Range Method: INTCAL20

Results are ISO/IEC-17025 accredited. All work was done at Beta in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" was calculated using the Libby half -life (5568 years), is corrected for total isotopic fraction and was used for calendar calibration where applicable.The Age is rounded to the nearest 10years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted errors are 1sigma counting statistics. Calculated sigmas less than 30BP on the Conventional Radiocarbon Age are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C). d13C and d15N values are relative to VPDB. References for calendar calibrations are cited at the bottom of calibration graph pages.

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REPORT OF RADIOCARBON DATING ANALYSES

Ramalingam Sivanantham — Report Date: February 22, 2021

Tamil Nadu Department of Archaeology — Material Received: February 02, 2021

Laboratory Number	Sample Code Number	Conventional Radiocarbon Age (BP) or Percent Modern Carbon (pMC) & Stable Isotopes	
Beta - 583589	**ADC1-003**	**3470 +/- 30 BP**	IRMS δ13C: -25.0 o/oo

(86.1%) 1885 - 1734 cal BC (3834 - 3683 cal BP)
(9.3%) 1719 - 1692 cal BC (3668 - 3641 cal BP)

Submitter Material: Charcoal
Pretreatment: (charred material) acid/alkali/acid
Analyzed Material: Charred material
Analysis Service: AMS-Standard delivery
Percent Modern Carbon: 64.92 +/- 0.24 pMC
Fraction Modern Carbon: 0.6492 +/- 0.0024
D14C: -350.77 +/- 2.42 o/oo
Δ14C: -356.32 +/- 2.42 o/oo (1950:2021)
Measured Radiocarbon Age: (without d13C correction): 3470 +/- 30 BP
Calibration: BetaCal4.20: HPD method: INTCAL20

Results are ISO/IEC-17025:2017 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" was calculated using the Libby half-life (5568 years), is corrected for total isotopic fraction and was used for calendar calibration where applicable. The Age is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted errors are 1 sigma counting statistics. Calculated sigmas less than 30 BP on the Conventional Radiocarbon Age are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C). d13C and d15N values are relative to VPDB-1. References for calendar calibrations are cited at the bottom of calibration graph pages.

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REPORT OF RADIOCARBON DATING ANALYSES

Ramalingam Sivanantham — Report Date: March 14, 2022

Tamil Nadu Department of Archaeology — Material Received: February 28, 2022

Laboratory Number	Sample Code Number	Conventional Radiocarbon Age (BP) or Percent Modern Carbon (pMC) & Stable Isotopes	
Beta - 620259	**MLP1-004**	**3760 +/- 30 BP**	IRMS δ13C: -24.6 o/oo

(64.8%)	**2239 - 2127 cal BC**	**(4188 - 4076 cal BP)**
(15.5%)	**2287 - 2246 cal BC**	**(4236 - 4195 cal BP)**
(15.2%)	**2093 - 2041 cal BC**	**(4042 - 3990 cal BP)**

Submitter Material: Charcoal
Pretreatment: (charred material) acid/alkali/acid
Analyzed Material: Charred material
Analysis Service: AMS-Standard delivery
Percent Modern Carbon: 62.62 +/- 0.23 pMC
Fraction Modern Carbon: 0.6262 +/- 0.0023
D14C: -373.79 +/- 2.34 o/oo
Δ14C: -379.22 +/- 2.34 o/oo (1950:2022)
Measured Radiocarbon Age: (without d13C correction): 3750 +/- 30 BP
Calibration: BetaCal4.20: HPD method: INTCAL20

Results are ISO/IEC-17025:2017 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" was calculated using the Libby half-life (5568 years), is corrected for total isotopic fraction and was used for calendar calibration where applicable. The Age is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted errors are 1 sigma counting statistics. Calculated sigmas less than 30 BP on the Conventional Radiocarbon Age are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C). d13C and d15N values are relative to VPDB. References for calendar calibrations are cited at the bottom of calibration graph pages.

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REPORT OF RADIOCARBON DATING ANALYSES

Ramalingam Sivanantham — Report Date: February 22, 2021

Tamil Nadu Department of Archaeology — Material Received: February 02, 2021

Laboratory Number	Sample Code Number	Conventional Radiocarbon Age (BP) or Percent Modern Carbon (pMC) & Stable Isotopes	
Beta - 583594	**SGI1-003**	**4300 +/- 30 BP**	IRMS δ13C: -24.2 o/oo

(80.7%)	**2939 - 2881 cal BC**	**(4888 - 4830 cal BP)**
(11.3%)	**3011 - 2974 cal BC**	**(4960 - 4923 cal BP)**
(3.4%)	**2969 - 2948 cal BC**	**(4918 - 4897 cal BP)**

Submitter Material: Charcoal
Pretreatment: (charred material) acid/alkali/acid
Analyzed Material: Charred material
Analysis Service: AMS-Standard delivery
Percent Modern Carbon: 58.55 +/- 0.22 pMC
Fraction Modern Carbon: 0.5855 +/- 0.0022
D14C: -414.50 +/- 2.19 o/oo
Δ14C: -419.51 +/- 2.19 o/oo (1950:2021)
Measured Radiocarbon Age: (without d13C correction): 4290 +/- 30 BP
Calibration: BetaCal4.20: HPD method: INTCAL20

Results are ISO/IEC-17025:2017 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" was calculated using the Libby half-life (5568 years), is corrected for total isotopic fraction and was used for calendar calibration where applicable. The Age is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted errors are 1 sigma counting statistics. Calculated sigmas less than 30 BP on the Conventional Radiocarbon Age are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C). d13C and d15N values are relative to VPDB-1. References for calendar calibrations are cited at the bottom of calibration graph pages.

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REPORT OF RADIOCARBON DATING ANALYSES

Ramalingam Sivanantham — Report Date: February 22, 2021

Tamil Nadu Department of Archaeology — Material Received: February 02, 2021

Laboratory Number	Sample Code Number	Conventional Radiocarbon Age (BP) or Percent Modern Carbon (pMC) & Stable Isotopes	
Beta - 583592	**SGI1-001**	**4540 +/- 30 BP**	IRMS δ13C: -23.5 o/oo

(61.5%)	**3243 - 3102 cal BC**	**(5192 - 5051 cal BP)**
(32.4%)	**3368 - 3282 cal BC**	**(5317 - 5231 cal BP)**
(1.5%)	**3276 - 3266 cal BC**	**(5225 - 5215 cal BP)**

Submitter Material: Charcoal
Pretreatment: (charred material) acid/alkali/acid
Analyzed Material: Charred material
Analysis Service: AMS-Standard delivery
Percent Modern Carbon: 56.83 +/- 0.21 pMC
Fraction Modern Carbon: 0.5683 +/- 0.0021
D14C: -431.74 +/- 2.12 o/oo
Δ14C: -436.60 +/- 2.12 o/oo (1950:2021)
Measured Radiocarbon Age: (without d13C correction): 4520 +/- 30 BP
Calibration: BetaCal4.20: HPD method: INTCAL20

Results are ISO/IEC-17025:2017 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" was calculated using the Libby half-life (5568 years), is corrected for total isotopic fraction and was used for calendar calibration where applicable. The Age is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted errors are 1 sigma counting statistics. Calculated sigmas less than 30 BP on the Conventional Radiocarbon Age are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C). d13C and d15N values are relative to VPDB-1. References for calendar calibrations are cited at the bottom of calibration graph pages.

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REPORT OF RADIOCARBON DATING ANALYSES

Ramalingam Sivanantham — Report Date: February 22, 2021

Tamil Nadu Department of Archaeology — Material Received: February 02, 2021

Laboratory Number	Sample Code Number	Conventional Radiocarbon Age (BP) or Percent Modern Carbon (pMC) & Stable Isotopes	
Beta - 583593	**SGI1-002**	**4670 +/- 30 BP**	IRMS δ13C: -25.4 o/oo

(95.4%) 3519 - 3371 cal BC (5468 - 5320 cal BP)

Submitter Material: Charcoal
Pretreatment: (charred material) acid/alkali/acid
Analyzed Material: Charred material
Analysis Service: AMS-Standard delivery
Percent Modern Carbon: 55.91 +/- 0.21 pMC
Fraction Modern Carbon: 0.5591 +/- 0.0021
D14C: -440.86 +/- 2.09 o/oo
Δ14C: -445.64 +/- 2.09 o/oo (1950:2021)
Measured Radiocarbon Age: (without d13C correction): 4680 +/- 30 BP
Calibration: BetaCal4.20: HPD method: INTCAL20

Results are ISO/IEC-17025:2017 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" was calculated using the Libby half-life (5568 years), is corrected for total isotopic fraction and was used for calendar calibration where applicable. The Age is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted errors are 1 sigma counting statistics. Calculated sigmas less than 30 BP on the Conventional Radiocarbon Age are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C). d13C and d15N values are relative to VPDB-1. References for calendar calibrations are cited at the bottom of calibration graph pages.

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1946

बीरबल साहनी पुराविज्ञान संस्थान
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Lucknow-226 007
भारत (INDIA)

(भारत सरकार के विज्ञान और प्रौद्योगिकी विभाग का एक स्वायत्तशासी संस्थान)
(AN AUTONOMOUS INSTITUTE UNDER DEPARTMENT OF SCIENCE & TECHNOLOGY, GOVERNMENT OF INDIA)

संख्या
No. .....

दिनांक 31.12.2024
Dated .....

To

The Commissioner,
Department of Archaeology,
Government of Tamil Nadu,
Tamil Salai, Egmore, Chennai 600008.

Dear Sir,

Five urn pieces were dated using luminescence dating method in BSIP, Lucknow, and among them 2 of them were dated in PRL, Ahmedabad for reliability check. As dose rate measurements are stillongoing, the luminescence ages tabulated below are provisional. The ages are to be understood as this many years ago (since 2019 – sample collection year) the urns were made by firing in the kiln.

Sl. No.	Institute Name	Sample Code	Age (years)
1	BSIP	A2-Urn1_BSIP	4500±400
2	PRL	A2-Urn1_PRL	4400±400
3	BSIP	A2-Urn3_BSIP	3300±600
4	BSIP	L13-Urn2_BSIP	4000±300
5	BSIP	L13-Urn5_BSIP	3900±400
6	PRL	L13-Urn5_PRL	4500±300
7	BSIP	L13-Urn8_BSIP	4000±400

Thanks.

Dr. P. Morthekai
Scientist – D
morthekai@gmail.com / Mobile +91 9787952151

भौतिक अनुसंधान प्रयोगशाला
(भारत सरकार, अंतरिक्ष विभाग की यूनिट)
नवरंगपुरा, अहमदाबाद - 380 009, भारत

Physical Research Laboratory
(A Unit of Dept. of Space, Govt. of India)
Navrangpura, Ahmedabad - 380 009, India

14th Jan 2023

To

The Commissioner
Department of Archaeology
Government of Tamil Nadu
Tamil Salai , Egmore Chennai 600008

Dear Sir,

Two urn pieces of Sivagalai urns were dated using luminescence dating method in PRL, Ahmedabad. The ages below are tentative as dose rate measurements are still pending.

Sl. No.	Institute Name	Sample Code	Age (years)
1	PRL	A2-Urn1_PRL	4400±400
2	PRL	L13-Urn5_PRL	4500±300

Ms. Malika Singhal is involved in the project under my supervision.

Thanks.

14-01-2023

Dr. Naveen Chauhan

Dr. Naveen Chauhan, Associate Professor, AMOPH Division
Office Phone: +91-79-2631-4753, Mobile: +91-8076266801
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REPORT OF RADIOCARBON DATING ANALYSES

Ramalingam Sivanantham — Report Date: August 27, 2021

Tamil Nadu Department of Archaeology — Material Received: August 18, 2021

Laboratory Number	Sample Code Number	Conventional Radiocarbon Age (BP) or Percent Modern Carbon (pMC) & Stable Isotopes	
Beta - 600727	**SGI2019-1-002**	**2560 +/- 30 BP**	IRMS δ13C: -25.6 o/oo
(60.0%)	**805 - 747 cal BC**	**(2754 - 2696 cal BP)**	
(24.9%)	**643 - 564 cal BC**	**(2592 - 2513 cal BP)**	
(10.5%)	**689 - 665 cal BC**	**(2638 - 2614 cal BP)**	

Submitter Material: Organics (husk with soil)
Pretreatment: (plant material) acid/alkali/acid
Analyzed Material: Plant material
Analysis Service: AMS-PRIORITY delivery
Percent Modern Carbon: 72.71 +/- 0.27 pMC
Fraction Modern Carbon: 0.7271 +/- 0.0027
D14C: -272.90 +/- 2.72 o/oo
Δ14C: -279.12 +/- 2.72 o/oo (1950:2021)
Measured Radiocarbon Age: (without d13C correction): 2570 +/- 30 BP
Calibration: BetaCal4.20: HPD method: INTCAL20

Results are ISO/IEC-17025:2017 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" was calculated using the Libby half-life (5568 years), is corrected for total isotopic fraction and was used for calendar calibration where applicable. The Age is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted errors are 1 sigma counting statistics. Calculated sigmas less than 30 BP on the Conventional Radiocarbon Age are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C). d13C and d15N values are relative to VPDB-1. References for calendar calibrations are cited at the bottom of calibration graph pages.

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REPORT OF RADIOCARBON DATING ANALYSES

Ramalingam Sivanantham — Report Date: October 14, 2022

Tamil Nadu Department of Archaeology — Material Received: September 26, 2022

Laboratory Number	Sample Code Number	Conventional Radiocarbon Age (BP) or Percent Modern Carbon (pMC) & Stable Isotopes	
Beta - 640432	**PBI/2022- 005**	**2540 +/- 30 BP**	IRMS δ13C: -23.4 o/oo
(42.9%)	**649 - 547 cal BC**	**(2598 - 2496 cal BP)**	
(37.0%)	**796 - 739 cal BC**	**(2745 - 2688 cal BP)**	
(15.5%)	**694 - 663 cal BC**	**(2643 - 2612 cal BP)**	

Submitter Material: Charcoal
Pretreatment: (charred material) acid/alkali/acid
Analyzed Material: Charred material
Analysis Service: AMS-Standard delivery
Percent Modern Carbon: 72.89 +/- 0.27 pMC
Fraction Modern Carbon: 0.7289 +/- 0.0027
D14C: -271.09 +/- 2.72 o/oo
Δ14C: -277.41 +/- 2.72 o/oo (1950:2022)
Measured Radiocarbon Age: (without d13C correction): 2510 +/- 30 BP
Calibration: BetaCal4.20: HPD method: INTCAL20

Results are ISO/IEC-17025:2017 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" was calculated using the Libby half-life (5568 years), is corrected for total isotopic fraction and was used for calendar calibration where applicable. The Age is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted errors are 1 sigma counting statistics. Calculated sigmas less than 30 BP on the Conventional Radiocarbon Age are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C). d13C and d15N values are relative to VPDB. References for calendar calibrations are cited at the bottom of calibration graph pages.

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REPORT OF RADIOCARBON DATING ANALYSES

Ramalingam Sivanantham — Report Date: October 14, 2022

Tamil Nadu Department of Archaeology — Material Received: September 26, 2022

Laboratory Number	Sample Code Number	Conventional Radiocarbon Age (BP) or Percent Modern Carbon (pMC) & Stable Isotopes	
Beta - 640430	**PBI/2022 - 003**	**2440 +/- 30 BP**	IRMS δ13C: -24.5 o/oo
(62.3%)	**591 - 408 cal BC**	**(2540 - 2357 cal BP)**	
(22.3%)	**751 - 684 cal BC**	**(2700 - 2633 cal BP)**	
(9.7%)	**668 - 634 cal BC**	**(2617 - 2583 cal BP)**	
(1.1%)	**622 - 613 cal BC**	**(2571 - 2562 cal BP)**	

Submitter Material: Charcoal
Pretreatment: (charred material) acid/alkali/acid
Analyzed Material: Charred material
Analysis Service: AMS-Standard delivery
Percent Modern Carbon: 73.80 +/- 0.28 pMC
Fraction Modern Carbon: 0.7380 +/- 0.0028
D14C: -261.95 +/- 2.76 o/oo
Δ14C: -268.35 +/- 2.76 o/oo (1950:2022)
Measured Radiocarbon Age: (without d13C correction): 2430 +/- 30 BP
Calibration: BetaCal4.20: HPD method: INTCAL20

Results are ISO/IEC-17025:2017 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" was calculated using the Libby half-life (5568 years), is corrected for total isotopic fraction and was used for calendar calibration where applicable. The Age is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted errors are 1 sigma counting statistics. Calculated sigmas less than 30 BP on the Conventional Radiocarbon Age are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C). d13C and d15N values are relative to VPDB. References for calendar calibrations are cited at the bottom of calibration graph pages.

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REPORT OF RADIOCARBON DATING ANALYSES

Dr. K. Rajan

Report Date: 8/4/2011

Pondicherry University

Material Received: 7/22/2011

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 302854	2430 +/- 30 BP	-24.3 o/oo	2440 +/- 30 BP

SAMPLE : PTL-MEG-I
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (organic sediment): acid washes
2 SIGMA CALIBRATION : Cal BC 750 to 680 (Cal BP 2700 to 2630) AND Cal BC 670 to 610 (Cal BP 2620 to 2560)
Cal BC 600 to 410 (Cal BP 2560 to 2360)

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

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REPORT OF RADIOCARBON DATING ANALYSES

Ramalingam Sivanantham — Report Date: February 22, 2021

Tamil Nadu Department of Archaeology — Material Received: February 02, 2021

Laboratory Number	Sample Code Number	Conventional Radiocarbon Age (BP) or Percent Modern Carbon (pMC) & Stable Isotopes	
Beta - 583575	**KLD6-006**	**2380 +/- 30 BP**	IRMS δ13C: -27.6 o/oo
(93.9%)	**542 - 393 cal BC**	**(2491 - 2342 cal BP)**	
(0.9%)	**716 - 711 cal BC**	**(2665 - 2660 cal BP)**	
(0.6%)	**659 - 655 cal BC**	**(2608 - 2604 cal BP)**	

Submitter Material: Charcoal
Pretreatment: (charred material) acid/alkali/acid
Analyzed Material: Charred material
Analysis Service: AMS-Standard delivery
Percent Modern Carbon: 74.36 +/- 0.28 pMC
Fraction Modern Carbon: 0.7436 +/- 0.0028
D14C: -256.42 +/- 2.78 o/oo
Δ14C: -262.78 +/- 2.78 o/oo (1950:2021)
Measured Radiocarbon Age: (without d13C correction): 2420 +/- 30 BP
Calibration: BetaCal4.20: HPD method: INTCAL20

Results are ISO/IEC-17025:2017 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" was calculated using the Libby half-life (5568 years), is corrected for total isotopic fraction and was used for calendar calibration where applicable. The Age is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted errors are 1 sigma counting statistics. Calculated sigmas less than 30 BP on the Conventional Radiocarbon Age are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C). d13C and d15N values are relative to VPDB-1. References for calendar calibrations are cited at the bottom of calibration graph pages.

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REPORT OF RADIOCARBON DATING ANALYSES

Ramalingam Sivanantham — Report Date: February 22, 2021

Tamil Nadu Department of Archaeology — Material Received: February 02, 2021

Laboratory Number	Sample Code Number	Conventional Radiocarbon Age (BP) or Percent Modern Carbon (pMC) & Stable Isotopes	
Beta - 583579	**KLD6-010**	**2490 +/- 30 BP**	IRMS δ13C: -25.1 o/oo
(94.1%)	**775 - 514 cal BC**	**(2724 - 2463 cal BP)**	
(1.3%)	**500 - 486 cal BC**	**(2449 - 2435 cal BP)**	

Submitter Material: Charcoal
Pretreatment: (charred material) acid/alkali/acid
Analyzed Material: Charred material
Analysis Service: AMS-Standard delivery
Percent Modern Carbon: 73.35 +/- 0.27 pMC
Fraction Modern Carbon: 0.7335 +/- 0.0027
D14C: -266.53 +/- 2.74 o/oo
Δ14C: -272.81 +/- 2.74 o/oo (1950:2021)
Measured Radiocarbon Age: (without d13C correction): 2490 +/- 30 BP
Calibration: BetaCal4.20: HPD method: INTCAL20

Results are ISO/IEC-17025:2017 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" was calculated using the Libby half-life (5568 years), is corrected for total isotopic fraction and was used for calendar calibration where applicable. The Age is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted errors are 1 sigma counting statistics. Calculated sigmas less than 30 BP on the Conventional Radiocarbon Age are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C). d13C and d15N values are relative to VPDB-1. References for calendar calibrations are cited at the bottom of calibration graph pages.

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REPORT OF RADIOCARBON DATING ANALYSES

Dr. K. Rajan

Report Date: 9/26/2011

Pondicherry University

Material Received: 9/15/2011

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 305904	2390 +/- 30 BP	-24.6 o/oo	2400 +/- 30 BP

SAMPLE : PTL-MEG-IV
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (organic sediment): acid washes
2 SIGMA CALIBRATION : Cal BC 720 to 700 (Cal BP 2670 to 2650) AND Cal BC 540 to 400 (Cal BP 2490 to 2350)

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

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REPORT OF RADIOCARBON DATING ANALYSES

Ramalingam Sivanantham — Report Date: February 22, 2021

Tamil Nadu Department of Archaeology — Material Received: February 02, 2021

Laboratory Number	Sample Code Number	Conventional Radiocarbon Age (BP) or Percent Modern Carbon (pMC) & Stable Isotopes	
Beta - 583576	**KLD6-007**	**2470 +/- 30 BP**	IRMS δ13C: -25.6 o/oo

(93.3%)	**766 - 465 cal BC**	**(2715 - 2414 cal BP)**
(2.1%)	**436 - 422 cal BC**	**(2385 - 2371 cal BP)**

Submitter Material: Charcoal
Pretreatment: (charred material) acid/alkali/acid
Analyzed Material: Charred material
Analysis Service: AMS-Standard delivery
Percent Modern Carbon: 73.53 +/- 0.27 pMC
Fraction Modern Carbon: 0.7353 +/- 0.0027
D14C: -264.71 +/- 2.75 o/oo
Δ14C: -270.99 +/- 2.75 o/oo (1950:2021)
Measured Radiocarbon Age: (without d13C correction): 2480 +/- 30 BP
Calibration: BetaCal4.20: HPD method: INTCAL20

Results are ISO/IEC-17025:2017 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" was calculated using the Libby half-life (5568 years), is corrected for total isotopic fraction and was used for calendar calibration where applicable. The Age is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted errors are 1 sigma counting statistics. Calculated sigmas less than 30 BP on the Conventional Radiocarbon Age are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C). d13C and d15N values are relative to VPDB-1. References for calendar calibrations are cited at the bottom of calibration graph pages.

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ISO/IEC 17025:2005-Accredited Testing Laboratory

REPORT OF RADIOCARBON DATING ANALYSES

J. Ranjith

Tamil Nadu Government

Report Date: March 11, 2019

Material Received: February 25, 2019

Laboratory Number	Sample Code Number	Conventional Radiocarbon Age (BP) or Percent Modern Carbon (pMC) & Stable Isotopes Calendar Calibrated Results: 95.4 % Probability High Probability Density Range Method (HPD)	
Beta - 519476	**KLD-2018/Sample No.1**	**2530 +/- 30 BP**	IRMS δ13C: -23.8 o/oo
(45.7%)	**651 - 543 cal BC**	**(2600 - 2492 cal BP)**	
(35.8%)	**797 - 731 cal BC**	**(2746 - 2680 cal BP)**	
(13.9%)	**691 - 660 cal BC**	**(2640 - 2609 cal BP)**	

Submitter Material: Charcoal
Pretreatment: (charred material) acid/alkali/acid
Analyzed Material: Charred material
Analysis Service: AMS-Standard delivery
Percent Modern Carbon: 72.98 +/- 0.27 pMC
Fraction Modern Carbon: 0.7298 +/- 0.0027
D14C: -270.18 +/- 2.73 o/oo
Δ14C: -276.24 +/- 2.73 o/oo(1950:2,019.00)
Measured Radiocarbon Age: (without d13C correction): 2510 +/- 30 BP
Calibration: BetaCal3.21: HPD method: INTCAL13

Results are ISO/IEC-17025:2005 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" was calculated using the Libby half-life (5568 years), is corrected for total isotopic fraction and was used for calendar calibration where applicable. The Age is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted errors are 1 sigma counting statistics. Calculated sigmas less than 30 BP on the Conventional Radiocarbon Age are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C). d13C and d15N values are relative to VPDB-1. References for calendar calibrations are cited at the bottom of calibration graph pages.

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REPORT OF RADIOCARBON DATING ANALYSES

Ramalingam Sivanantham — Report Date: February 22, 2021

Tamil Nadu Department of Archaeology — Material Received: February 02, 2021

Laboratory Number	Sample Code Number	Conventional Radiocarbon Age (BP) or Percent Modern Carbon (pMC) & Stable Isotopes	
Beta - 583578	**KLD6-009**	**2400 +/- 30 BP**	IRMS δ13C: -26.3 o/oo
(86.3%)	**546 - 397 cal BC**	**(2495 - 2346 cal BP)**	
(6.0%)	**732 - 698 cal BC**	**(2681 - 2647 cal BP)**	
(3.1%)	**664 - 650 cal BC**	**(2613 - 2599 cal BP)**	

Submitter Material: Charcoal
Pretreatment: (charred material) acid/alkali/acid
Analyzed Material: Charred material
Analysis Service: AMS-Standard delivery
Percent Modern Carbon: 74.17 +/- 0.28 pMC
Fraction Modern Carbon: 0.7417 +/- 0.0028
D14C: -258.27 +/- 2.77 o/oo
Δ14C: -264.61 +/- 2.77 o/oo (1950:2021)
Measured Radiocarbon Age: (without d13C correction): 2420 +/- 30 BP
Calibration: BetaCal4.20: HPD method: INTCAL20

Results are ISO/IEC-17025:2017 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" was calculated using the Libby half-life (5568 years), is corrected for total isotopic fraction and was used for calendar calibration where applicable. The Age is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted errors are 1 sigma counting statistics. Calculated sigmas less than 30 BP on the Conventional Radiocarbon Age are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C). d13C and d15N values are relative to VPDB-1. References for calendar calibrations are cited at the bottom of calibration graph pages.

NSF-Arizona AMS Laboratory

Data Report - radiocarbon age BP

University of Arizona - PAS Building
1118 E. 4th Street
P.O. Box 210081

AA	lab #	sample ID	MASS	d13C	run date	F (d13C)	dF (d13C)	14C age BP	d14C age
AA99856	X24388	#2-KDL-CH2	1.79mg	-23.6	N01-10-13	0.7580	0.0039	2,225	41
AA99855	X24387	#1-KDL-CH1	1.86mg	-12.0	N01-10-13	0.6294	0.0035	2,358	40

Kodumanal: AMS Date

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REPORT OF RADIOCARBON DATING ANALYSES

Dr. K. Rajan

Report Date: 9/18/2012

Pondicherry University

Material Received: 9/13/2012

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 330303	2270 +/- 30 BP	-24.2 o/oo	2280 +/- 30 BP

SAMPLE : KDL-ZD10-1
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal BC 400 to 350 (Cal BP 2350 to 2300) AND Cal BC 290 to 230 (Cal BP 2240 to 2180)

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

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REPORT OF RADIOCARBON DATING ANALYSES

Dr. K. Rajan

Report Date: 6/3/2013

Pondicherry University

Material Received: 5/28/2013

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 349958	2220 +/- 30 BP	-22.9 o/oo	2250 +/- 30 BP

SAMPLE : KDL-ZD20
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal BC 390 to 350 (Cal BP 2340 to 2300) AND Cal BC 320 to 210 (Cal BP 2270 to 2160)

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

GOVERNMENT OF TAMIL NADU
DEPARTMENT OF ARCHAEOLOGY

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